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BEFORE THE CALIFORNIA ENERGY COMMISSION

JOINT AGENCY WORKSHOP ON THE PROPOSED

RENEWABLE ENERGY TRANSMISSION INITIATIVE (RETI) 2.0

In the Matter of:	)	
	)	Docket No. 15-RETI-02
Renewable Energy Transmission	)	
Initiative	)	
	)	

CALIFORNIA ENERGY COMMISSION

ART ROSENFELD HEARING ROOM

1516 NINTH STREET

SACRAMENTO, CALIFORNIA

MONDAY, MAY 2, 2016

1:00 P.M.

Reported by:

Peter Petty

APPEARANCES

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Karen Douglas, Commissioner

STAFF

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Saul Gomez, Deputy Secretary

California Public Utilities Commission (CPUC)

Michael Picker, President

Carla Peterman, Commissioner

United States Bureau of Land Management (BLM)

Jerry Perez, State Director

APPEARANCES

PRESENTERS

Brian Turner, RETI 2.0 Project Director Hal Harvey, Energy Innovation

Nancy Rader, California Wind Energy Association

PUBLIC COMMENT

Brian Biering, Duke American Transmission Company

David Smith, TransWest Express/Power Company of Wyoming

Renae Steichen, Smart Wires

Erica Brand, Nature Conservancy

Kate Kelly, Defenders of Wildlife

Nathan Bengtsson, Pacific Gas & Electric

Julia Prochnik, Natural Resources Defense Council

Rachel Gold, Large-Scale Solar Association (via WebEx)

Steve Uhler (via WebEx)

AGENDA

P R O C E E D I N G S

1:01 P.M.

SACRAMENTO, CALIFORNIA, MONDAY, MAY 2, 2016

MR. TURNER: Good morning, everybody. Why don't I go ahead and get the housekeeping issues out of the way. My name is Brian Turner. I'm the Project Director for RETI 2.0. And I'm going to turn it over to Chairman Weisenmiller who is our Chair for the activities today.

But first, let me get some housekeeping issues out of the way.

This workshop is being recorded. A copy of the recording will be available on the RETI website a few days after the workshop, and notice will be sent to the RETI listserv. Information about RETI 2.0 is sent to those who have joined the RETI listserv. There's a handout on the table in the foyer with instructions on how to join the listserv. Only the RETI list will receive emails on this topic.

For those of you in the hearing room, we will have a public comment session at the end of the day. If you wish to make public comments, please fill out a blue speaker card and leave it in the box on the table in the foyer, and then speakers will be called to the podium by the Chair. Please speak directly into the microphone on the podium so that

those on WebEx will be able to hear you.

After those stakeholders have made their comments, we will call on WebEx participants who have indicated through the raised hand feature that they would like to comment. We will unmute the phone line for each caller as we call on them. Please be aware that using this feature, your hand will remain raised until you remove it. Alternatively, please send a private message to the WebEx host stating that you'd like to speak so that we may call on you.

A three-minute timer will be on screen for all commenters.

It helps us to know who's here for the workshop. So we would appreciate your signing in the sheets that Staff will now pass to you, or invite you to pass your business card to those Staff.

And now I'll ask Chairman Weisenmiller and the other principals here to give us some introductory comments.

CHAIRMAN WEISENMILLER: Good afternoon. I'd like to welcome everyone to the Energy Commission for today's workshop. This is a workshop that's been in a series workshop on RETI 2.0. This is an opportunity for all the parties to discuss the next stage of California in the area of transmission. It's a joint activity with the various agencies. I'll let Saul explain the absence of John Laird.

John was called for a more pressing engagement. But anyway, again, I appreciate everyone's work today and the opportunity to get feedback from the staffs on the progress to date.

President Picker?

Do you want to go next?

MR. GOMEZ: Oh, great. Good afternoon. My name is Saul Gomez. I'm a Deputy Secretary at the Natural Resources Agency.

I just wanted to pass on John's apologies for not being here this afternoon, Secretary Laird's apologies for not being here this afternoon. He's with the Governor kicking off fire awareness season and at an event with him this afternoon, and so he couldn't make it.

But, you know, over the last couple or more than a couple of months the agency has very much enjoyed the work that we've been doing with Brian Turner and his colleagues at the various agencies. We've held a number of workshops already, and we're just very grateful for their work so far. And happy to have Brian as a colleague, and having the agency help facilitate this initiative. And we look forward to the presentation and the next few months to finish up this project. So thank you.

PRESIDENT PICKER: I don't have a great deal to add. I've spoken at some of the past workshops. I'm glad

that we're finally back together again. Mostly we've gotten briefings from Staff based on some of the other working groups. And so I think this is a good opportunity for us to sit together and ask questions and to hear some of the work coming together. Thank you.

MR. PEREZ: Good afternoon. Want to just thank everyone for coming, also. And I wanted to just acknowledge the good work and interagency coordination that has been done to date. For the Bureau of Land Management it's important to be looking at these things as we consider large scale land use planning efforts, such as the Desert Renewable Energy Conservation Plan. So looking forward to the presentations, thinking about how it fits in with DRECP, and appreciate just the work of the staff and everyone who's been engaged to date.

MR. BERBERICH: Good afternoon, everyone. I'm Steve Berberich, the CEO of the California ISO. We're delighted to be here, too.

Chair Weisenmiller, I really appreciate the invitation here today.

Working together, I think in a collaborative manner, to kind of continue to plan out California's clean energy future, also collaborating with all the different planning agencies here in the state from an environmental perspective, but also trying to find the best way to

leverage the existing transmission assets for the benefit, I think, of the ratepayers here in the state. So we keep all of that in mind as we move through this planning process. The ISO will continue to be committed to collaborating with all of you to find the best solution to leverage the resources we have in the area, and then the region. Thanks.

COMMISSIONER DOUGLAS: Hi. Good afternoon. Karen Douglas from the Energy Commission. I just wanted to say I'm looking forward to the presentations and comment, and I'm happy to be here.

MR. TURNER: Well, thank you very much, Chairman.

I'm going to -- this is Brian Turner. I'm the Project Director for RETI 2.0. I'm going to give a brief introduction to this first panel. And then I'm going to start with the first presentation of that panel. But I asked to put up the RETI 2.0 process and timeline here to give an overview of what we'll be doing today.

The purpose of today's workshop is to present to you and to the RETI 2.0 stakeholders our progress to date and where we would like to move in the next stage of RETI 2.0. You'll notice in this process and timeline a series of -- first across the top, the months of 2016, ending in September when we'll produce for you a report summarizing our findings. And I want to point to the middle row, the Plenary Group, which is really studying the resources that

may be useful to California to meet its 2030 greenhouse gas reduction and energy goals, and resulting in the report at the end.

And our focus today will be on those first two boxes. Where we've started is discussing what are the planning goals, and by this I mean what kind of -- what quantity of renewable resources may be required to reach our greenhouse gas goals by 2030, and then the resource values, meaning what's the latest and greatest about different renewable resources in California and around the West that can help us meet those goals. That's the first box. That's what we discussed back in January and February.

And then we have recently begun to focus in on what resources may be of most importance to making sure that we can access, if we may need them by 2030, and that may need transmission. So by the end of today we'll present to you, what are those planning goals, the very broad ballpark figures for renewable need, where our resources -- what's our most current information about where high value resources for meeting those 2030 goals may be, and which do we propose to study further in our next stage during RETI 2.0. So that would be our focus areas that we'll end off the day.

Also, I'll draw your attention to the green boxes up at the top and the red boxes down at the bottom, the

green boxes being input from the Environmental and Land Use Technical Group, and we'll have a presentation on that in a middle, and the red boxes being input from a Transmissions Technical Input Group of the system operators and transmission planners in California.

So that's the context of what we'll be doing. And I want to first launch into a bit of a discussion about our planning goals. I'm going to throw up another presentation here. The slides are a little -- in different places.

All right, so next slide please.

The background -- the purpose of the planning goal summary is to ballpark the scale of renewable need that may be needed by 2030 to reach our energy and greenhouse gas goals, and in the context of a western electric grid that's also decarbonizing and also meeting renewable goals. And we'll use this to guide the scale of demand that we estimate for the different renewable resources from specific geographic areas that may need transmission. I hope it's making sense, why this is kind of a logical progression.

First -- the next slide please.

To do this, we held a workshop back on January 29th, and also received quite a bit of comment and existing reports from the Energy Commission, the Public Utilities Commission, L.A. Department of Water and Power, Energy and Environmental Economics -- E3, and the Western Electricity

Coordinating Council. Those were all the folks that spoke at our workshop, although we received comment from many others, besides.

Next slide please.

So here is discussion of the California energy demand. This is a core product out of the Integrated Energy Policy Report (IEPR) produced by the Energy Commission. It's forecasted; the 2015 IEPR forecast from 2016 through 2026, at our request the CEC was able to extrapolate that very simple extrapolation out to 2030. Of course, the energy demand projection also includes additional achievable energy efficiency. And the IEPR that was released earlier this year did not include a projection of energy efficiency savings that conform with the new SB 350 direction to double our energy savings by 2030, although between the Energy Commission and the PUC, they did come up with a preliminary provisional projection of what that would mean and really it's a further reduction of about 10,000 gigawatt hours over what is already included in the IEPR projection by 2030.

Next slide please.

So here is a very simple projection using both that extrapolation of the IEPR demand case out to 2030, plus a 50 percent RPS. And this really, I want to set the stage, establishes our low end of the range of what may be required, especially this case of low demand, high AAEE,

again, that stands for energy efficiency. Off to the right there you see low demand. In 2030 the total retail sales that are RPS eligible may be as low as 205,000 gigawatt hours. And at 50 percent RPS, that would only need 102,000 renewables. And the incremental need then projected, again based on what we expect to have by 2020, would just be 24,000, perhaps rounded up to 25,000 gigawatt hours. So that's based on the IEPR demand and a 50 percent RPS.

Now we also took a good hard look at projections of what is required to reach our GHG goals by 2030. And just a reminder that between the governor's executive orders establishing an 80 percent GHG reduction by 2050 and a 40 percent economy-wide GHG reduction over 1990 levels by 2030, that's an economy-wide goal and requires thinking about the economy as an integrated hole and the different -- how each sector within the economy might reduce its greenhouse gas emissions.

And one tool for doing that kind of estimation is E3's California Pathways Model. This is an economy-wide, bottom-up, user-defined model, a spreadsheet model that has specific sector components to it. And it captures the interactions between the sectors. It captures infrastructure rollover. And it has a fairly detailed treatment of the electric sector with our hourly dispatch and demand.

And the purpose of using this model is to estimate what is the total, shall we say, decarbonization burden that may rest on the electricity sector and that may provide us more insight into the amount of renewables necessary to reach that kind of decarbonization goal in the electricity sector. And you'll see here amongst the sectors that are outlined in the supply sector off to the left in the red boxes what percent of renewables is necessary to reach that level of decarbonization. And that's really the question that we were getting at.

Next slide please.

The California Pathways Model was used in 2014 and 2015 by California agencies, most of those represented here, the PUC, CEC, ISO, as well as the Air Resources Board and the governor's office, as one supporting data point into the setting of the governor's 2030 goals. Its purpose was to evaluate the feasibility and cost of a range of GHG reductions goals that could help meet the 80 percent reduction over 1990 by 2050. So this was before we had set the 2030 40-percent reduction goal, and it was used as a way of estimating what could reasonably be achieved at a reasonable cost.

Now the Pathways Model is all -- and my data will be coming from this run of the model that was used in 2014-2015. So it is a little bit dated, and I think that's an

important caveat to make and to keep in mind.

It was used again -- it is being used again in the 2016 Scoping Plan, the same kind of modeling framework, but we don't yet have data out of that.

Next slide please.

This illustrates some of the key findings coming out of the Pathways Model, including that efficiency and conservation are absolutely critical to maintaining any kind of GHG reduction and lid on the total amount of energy demand that we'll have.

Fuel switching, a key component here, especially in building and vehicle electrification, that is, how do we remove the GHGs from transportation? Well, electrification, either by electric vehicles or hydrogen-electric vehicles seems to be a key strategy. And so that would entail substantially more electric demand is the key takeaway coming from that, as well as potentially building electrification, again, another source of increased demand on electricity. And at the same time, number three here, key takeaway, decarbonizing electricity supply. So you're moving more sectors of the economy onto electric supply, including, critically, transportation, and then decarbonizing that electricity supply.

And that's why one of the important points coming out the Pathways Model and for this process is the total

demand might be significantly higher than estimated in the Integrated Energy Policy Report, and the amount of decarbonizing within that electricity may be even higher than a 50 percent renewables. In the Pathways studies that were done, it reached even, I think, 56 percent in those runs. I think we've got a slide on it here.

Next slide please.

So here's -- all those graphs to the side show the total increase in energy demand. Those are going out to 2050. So it really starts to increase rapidly after 2030 as those -- as the stock turnover, the change in the transportation and the building sector increases electric demand. But the ramp-up starts well before 2030, as well. And you'll see the need for the yellow and blue there, they are wind and solar technologies. This was just modeled at a conceptual level, but it is showing the dramatic increase in renewables necessary to reach those greenhouse gas reduction goals.

Down to the bottom left you see a chart showing the percentage of renewables within the electric supply. And the dotted line, that's a little difficult to see, above the green line, so the green line is the straight line scenario. The straight line scenario only reached, I think it's a 33 percent reduction by 2030. The governor's goal, again, is 40 percent economy-wide. So the little dotted

line that goes above that is the early deployment scenario, and that gets closer, it gets to 38 percent GHG reduction by 2030 and requires up to 56 percent renewables on an increased electricity demand.

And that's really the conclusion here. It is, frankly, some pretty stunning numbers, I think, that total generation could more than triple by 2050, and renewables capacity could quintuple.

Next slide please.

I'm not going to go into much depth here. It's just one of the things that we studies were some of the major drivers of this demand and what variables matter the most. We looked closely at energy efficiency, transportation electrification, and behind-the-meter PV. You'll note that all these scenarios include really dramatic levels of behind-the-meter PV, and a pretty high level, except for the IEPR low case, pretty high levels of electric vehicles, as well.

Next slide.

And so here is a whole lot of stuff going on. The blue bar is total retail sales, RPS-eligible retail sales. And then the purple line next to that is the total renewables required under each of these scenarios for a 60 percent RPS, then a total renewables at a 50 percent RPS. And then the little blue and little green lines are the

incremental renewables. So this is really kind of the bottom line slide in many ways, how much more renewables might we need to reach these goals?

All the way to the left is the low IEPR case low demand. All the way to the right is the Pathways early deployment and relatively -- I mean, still very high behind-the-meter PV, rooftop solar, community solar. But, compared to other scenarios, a mid case of behind-the-meter PV.

So this yields a range of incremental renewables demand of 25 to 108 terawatt hours, 108,000 gigawatt hours, which is really quite large. And at the end here I'll translate what that could mean in capacity numbers, but trying to keep it in energy numbers to avoid talking about specific technologies that could fit that energy need.

Next slide. Thanks. Oh, that went backwards. Forward. Yup, there we go.

Just a brief note about west-wide demand. So the Western Electricity Coordinating Council Transmission Expansion Planning Policy Committee, TEPPC, does a projection of what is RPS demand around the west and how much is met and how much is still left out there. The most recent case for the 2026, not 2030, 2026 estimates that there's about a net short of 25,000 gigawatt hours in other RPS states, so that's double or, once again, 100 percent of our low case in California. That may be met by development

in non-RPS states. So it seems like the current RPS-driven demand in the rest of the West is relatively modest. There are many factors, of course, that could drive this higher, including the Clean Power Plan. New RPS is under consideration elsewhere in the West, and economics, frankly, other drivers.

So next slide, and this is my final slide.

The conclusions are reaching a 50 percent RPS under low demand conditions could entail relatively modest renewables expansion. However, reaching the 2030 greenhouse gas reduction goals and making sure that we are on track to meet the 2050 goals, with cross-sector effects, such as transportation, electrification, building electrification could increase both total electric demand, the amount of renewables needed to reach those decarbonizing goals, yielding this range of 25,000 gigawatts to over 100,000 gigawatts.

In capacity terms, you need to make some assumptions about capacity factor, which really matters, and we don't want to. A higher capacity factor means that you need less capacity and less capital for that capacity. If you're assuming a 40 percent capacity factor on average, that's 7 to 31 gigawatts of additional capacity. We currently have about 20,000 gigawatts -- sorry, 20 gigawatts of capacity in the state, very roughly, so that's -- and

then if you assume a 30 percent capacity factor, that's 9 to 41 gigawatts of additional capacity, which is pretty dramatic.

So that's the end of my planning goal summary.

And now I'd like to introduce -- who do we have up next? Was it Scott next? Yeah. So Scott, who is the Staff Lead for Environmental and Land Use Technical Group.

MR. FLINT: Great. Thanks Brian.

Good afternoon, everyone. I'm going to give you an update on the progress of the Environmental and Land Use Technical Group's work to date.

Misa, the next slide please.

So the charge of the Environmental and Land Use Technical Group is to identify, compile and make available statewide data and west-wide data, to the extent feasible, relevant to renewable energy planning. And then to basically recommend a way to use that information to evaluate combinations of areas identified by the Plenary Group and potential new transmission corridors that might come out of that work from an environmental perspective, and then to work interactively with the Plenary Group and the Transmission Technical Input Group to evaluate the different potential environmental effects of various areas and combinations of areas in this process.

Next slide please.

We have been doing that work diligently since December, assembling data sets, both normal data sets available statewide and refining and identifying the appropriate environmental data sets from the Desert Renewable Energy Conservation planning effort for the desert area of the state. And actually, during that time we had an ongoing stakeholder process in the San Joaquin Valley, looking at solar PV, potential siting and environmental effects. And so that report is about to be published, but that data is available. So looking at that data and seeing the most suitable data to use in the RETI 2.0 process.

And we explored all those data sets, most of those data sets statewide and area-specific in a series of workshops in December and January. And in April, this last month, we assembled a smaller working group who has started to drill in on evaluating the data and the approach to review the areas, so we'll talk a little bit about that progress.

Next slide please.

So what we have completed to date, and I'll briefly touch bases on a few of these items.

Assembled statewide data sets. We are going to make those data sets available in one gateway on the Conservation Biology Institute's Data Basin web gateway. That's not quite up and available yet. But we do have all

of the data up there in various places, so folks can see and view and work with that data.

We've asked the group to take a look at those data sets and recommend any additional data sets that they think might be needed that we may have missed in putting these together for evaluating areas and potential transmission corridors in this process. So we've assembled those. The gateway will be live in the next week or so, assembling all that data in one location.

We've identified a focus set of data for reporting out on in this process, and we've identified a preliminary reporting format for doing that reporting.

Next slide please.

So, environmental data sets that we have statewide that we can use for this process include information on protected areas. This data has recently been updated by California -- I'm sorry, by the Conservation Biology Institute (CBI), so we have a new set of protected area lands that are identified and mapped. These come from a couple of common sources, so they will have everyone's information already put together within them. And CBI has refined and checked that information.

We will have a terrestrial landscape intactness layer available statewide. Terrestrial landscape intactness is important from a conservation perspective for habitat

lands. The better intactness, the better for conservation value.

Federal designated critical habitat, we propose to use that, something that's available statewide and is designated by the federal government for some federally listed species.

We have positive siting occurrence date from the California Natural Diversity Database. This information is used various ways in the other data sets. But we also have that data set itself to bring to bear on answering questions.

We have areas of California conservation emphasis. This is a statewide data layer developed and maintained by the California Department of Fish and Wildlife. That essentially mirrors some of the attributes of the conservation value information that we put together in the DRECP area and in the San Joaquin Valley area.

We have a statewide Essential Habitat Connectivity Assessment. Again, this was put together by the California Department of Fish and Wildlife and Caltrans. It shows essentially areas for connecting those terrestrial areas that are highly intact and serve as keystone areas for conservation.

We have statewide important bird areas.

And we have statewide information on a couple of

different measures related to climate change we propose to report out on in relation to the areas identified in this process.

Next slide please.

So we've used this information in a couple different ways and other processes. In the DRECP, we used a lot of environmental information to put together and identify areas for conservation and areas for renewable energy development that had lower environmental values or potential conflicts when you got to the permitting stages. That's one way we use this information.

In the San Joaquin Valley we use the same sorts of biological information to do a different exercise where we had stakeholders build their own maps with the information and identify their sets of least conflict areas. So that was the approach taken in that process.

In the RETI 2.0 process we simply propose to report out on the information that might occur or underlie potential areas that we consider in this process. So we wouldn't be making any judgments about the suitability of the areas for one thing or another. We'd simply be reporting out the biological information and then summarizing it for these eight key data sets statewide.

Next slide.

So in addition to that, so the statewide data sets

do cover the whole state of California, and they certainly cover the other areas outside of the Desert Renewable Energy Conservation Plan area, which is in the southwestern portion of the map up here on the slide, and outside of the areas of the San Joaquin Valley which is central in the map here. The other areas highlighted here have high renewable resource potential and may be some of the areas that we'll be working on with RETI 2.0 to select resources to be examined. So the data covers -- the eight data sets we have cover the entire state, and certainly cover these areas.

In addition to that we'll be able to report out in the same format a second level of environmental information in the DRECP area and in the San Joaquin Valley area using the information that we've already developed in those processes. So in those -- within those areas we'd have two tiers or reporting, using the statewide data and using the regional data.

So the reason we're doing that is the statewide data is uniform across all the areas of the state. The data that we have in the two regions, San Joaquin Valley and DRECP, developed for those efforts is slightly different. In the regional data sets that we have, just for example, a couple of them are conservation value and terrestrial intactness developed specifically in DRECP for that area. And we can composite those values to get some other sorts of

information on condition of some of that, some of those areas. We don't have an agricultural values model, so weren't able to look at agricultural lands the same way or with any sort of uniform way across the area.

Next slide please.

In contrast, in the Central Valley exercise, again, we have a conservation values model, but built a little bit differently there, based on the data that was available. And we have an agricultural value model that we built there that also takes into account the value of the agricultural lands when considering potential environmental effects, but no terrestrial intactness layer built.

Next slide.

So our goal, and we have this out for review for the group now, is to assemble the information in that two-tiered fashion and do this simple summary reporting out of the information that underlies the areas identified.

Again, this is the part of the gateway that we're building for the RETI 2.0 data sets. So you'll be able to conveniently go to one place and see the statewide data sets, the DRECP data sets, and the San Joaquin Valley solar data sets, all in one place. Right now they're all available but they're scattered a bit around the Data Basin site. This will put them all in one place for folks to work with.

Next slide.

So right now we met with the group twice this month, laid out the data sets, laid out our proposal for using the data, and the proposed reporting format. So we're asking the group to comment back to us, give us their ideas and thoughts about this approach and that process, take a look at the available data sets, and identify any additional data that we might need to bring into Data Basin and then bring to bear on examining the areas. That's going on right now.

At the end of this month or sometime later this month we'll run a test area of the data reporting with one of the geographies that we identify working with the Plenary Group so that we can have a real look at how the data will come out when we do this.

We need to spend a little more time talking about how to evaluate aerial impacts, that's potential avian and bird and bat impacts, in some of the areas. The data there is not quite as mappable or available as the terrestrial data that we've been -- that I've been presenting a little earlier here, so we need to work on that. We have bird areas, important bird areas identified. We have some information in the conservation emphasis data layer. But we need to do some more work and talk about how to actually report this out, so that's some of our next step work. And

then we need to talk about a way to summarize profiles and compare between the areas. So that will be a next step for the group.

Next slide please.

So we've been concentrating so far on collecting the data and doing the work here in California to get that up and running and be able to evaluate the areas identified here. We will also look beyond California to the westwide WECC area and be working with the folks who developed the WECC Environmental Data Tool. And this display that you see here is set up, and there are four categories to evaluate potential transmission. We will work with the group and we'll look to the data that underlies this to be able to compare and contrast it to the data that we've identified for the areas in California so that we can have some useful, as much useful comparison as possible inside and outside the state with the data sets. So that's another next step.

Next slide please.

Well, that's a little further next step down the road, so that one is just a little further. Two things there. I just mentioned the WECC environmental data, data from other states. You know, any project-specific area data sets from outside that might help us with an environmental evaluation, we also will look at. And we also need to integrate local land use data, which you don't see showing

up here. We've concentrated on, A, California, B, biological data. So another next step will be bringing in the results of local planning efforts, particularly in the DRECP area, for the local agencies that have done step-down planning or their own additional planning for renewable resources in their counties in a general plan sense. So we will be bringing that information into the process.

That's it.

MR. TURNER: Great. Thank you, Scott.

Now Neil Millar, our Staff Lead for the Transmission Technical Input Group, a summary of the information that they've gathered to date.

MR. MILLAR: Thank you and good afternoon.

Next slide please. Thank you.

And just to recap, the purpose of the Transmission Group is really to provide information on the capabilities of the existing system, as well as the system with transmission plans that are already underway, as well as to be able to discuss the implications of accessing some of these pockets of renewable generation as that work evolves through the Plenary Group and the Environmental Group. The membership of the Transmission Technical Input Group is really focused on the California planning entities, the NERC-registered transmission planning organizations, recognizing that the focus is to gather information, both on

the capabilities inside the system, as well as capabilities outside of California, turning to other data sources.

Next slide please.

So our primary sources for instate is from the planning entities themselves to provide the information they have available through current or previous study work that would be relevant to this topic. We're also turning to the Western Interstate Energy Board for some of the other analysis that's been done more globally. And also turning outside of the state to individual transmission project developers that have been bringing forward projects over some number of years seeking to bring renewable resources to California, both to assess the viability of accessing those resources, as well as to understand the kind of transmission projects necessary.

Next slide please.

So the methodology for the California system has really -- or sorry, for the California ISO footprint has really focused on two aspects, both how much transmission is available to make additional resources available that would qualify for the resource adequacy programs, the deliverability aspect, as well as to look at the capabilities of the system if we consider that we have sufficient deliverability, sufficient resource adequacy capacity, and are looking for energy-only resources.

The other California transmission planning entities have provided their own input directly on the capabilities of their systems. And we've also had to consider that the out-of-state capability isn't only limited by the transmission outside of California, but also the capabilities of the system from the injection point into California to get through to actually serve load. So, on that basis we've been looking at this from a few different angles.

Next slide please.

This slide that I think many of you have seen before in other work are the projects that are currently underway within the ISO footprint. Some of these started many years ago. A number of them are completed. I won't go through the individual list publicly, but just wanted to make sure you're aware that we've provided this information on the various projects that were either developed in part of wholly to access renewable resources and are largely the framework for much of the existing capacity we see in the immediate future.

Next slide please.

As well, in our last transmission planning study we did assess the capabilities of that system, focusing not only on the potential to achieve 33 percent, but also started to look beyond at what was available to achieve a 50

percent RPS goal. We have not looked beyond the 50 percent for even the more aggressive load and renewable generation scenarios that Brian discussed earlier.

Our work on the full capacity delivery status, the deliverable resources, has really been informed both by our transmission planning process, as well as various generator interconnection studies over the last few years that show that we have considerable transmission available that could provide deliverability to resources, but nowhere near what it would take to achieve the 50 percent goal, but to go well beyond 33 percent, anywhere perhaps from one-third to half of the capability, depending on where the resources are located.

Next slide please.

The other work that was done last year on a special study basis, strictly for information purposes, was to take some scenarios that were developed by the Public Utilities Commission, strictly for that purpose, and to test the ability to deliver energy-only resources without seeing an unacceptably high level of curtailment. And what that work demonstrated was that the system really has a considerable capability to absorb energy-only resources without requiring additional bulk system reinforcements, providing that we're not in the market for resource adequacy capacity, and also depending on where those resources are

located.

So as we've indicated here the energy-only capacity spread across the state could translate to over 20,000 megawatts, subject to some level of curtailment, but what look like a manageable amount in the course of the transmission study.

Next slide please.

As well as the ISO footprint, we have received input from the other planning entities within the state on various transmission projects that are either underway or under development and are being actively pursued. Those projects also provide additional capability beyond that that was identified in the ISO footprint.

Next slide please.

When we're looking at the out-of-state transmission, we've been looking at this a few different ways. One was to draw some information developed primarily through WECC and through the Western Interstate Energy Board, looking at the amount of curtailment that already exists on the existing transmission system, just to see what kind of capabilities we should be expecting from the system that's already there.

And if I could turn to the next slide please?

We're also working through the interregional transmission planning processes that were put in place,

largely due to the FERC Order 1000 process where we're starting to coordinate with the neighboring planning entities and, in particular, starting some studies this year that will be ongoing and will lead into results towards the end of the year or early 2017. We're looking at various capabilities outside of the state.

In the meantime, if I could turn to the next slide?

We are looking at a number of transmission projects that have been brought forward by interested developers. The list here is in a bit of a random order, but I should mention that several of these projects, in particular TransWest Express and the Zephyr Project are primarily HVDC alternatives, looking at bringing Wyoming wind into the California system through different injection points.

We also have the AC alternatives, the Gateway Projects that have been primarily led by PacifiCorp, as well as the Southwest Intertie Project from midpoint Idaho to Robinson Summit, Nevada, that would also allow access on a more graduated approach to Wyoming resources.

There are also a number of projects that are primarily between Arizona and New Mexico that would provide greater access to New Mexico wind resources and would rely on the existing system between Arizona and California to

bring those resources the rest of the way in. Those include the SunZia Project, the Western Spirit Project. And I'm afraid we may have missed on one this list. The Southline Project is another one that's been identified.

The Desert Tortoise Expressway Project is one that's been suggested to us by San Diego Gas and Electric, which is to convert part of the existing SWIP 500-kv AC project to a DC line to provide greater access to capability on that path.

Next slide please.

So just in summary, we do want to be clear that we do see additional transmission capacity available, especially on an energy-only basis. The deliverability consideration, the need for additional resource adequacy capacity from the renewable resources would be critical, that's a critical decision that would really influence the transmission planning going forward.

We also see that there's enough evidence to support that the out-of-state resources are technically viable, but the decision would be needed to be made to pursue those resources for these projects to come to be, and that in doing so we will also have to consider any implications on the California system getting the power from the injection point to the load centers.

So that's my overview. And we'll look forward to

questions.

MR. TURNER: Thanks. Let's -- we had those three presentations for our first panel this morning to give you the background into what we've done to date and what's informing our looking going forward in terms of what we need.

Any questions or discussion from the dais?

PRESIDENT PICKER: I know that the data sets that we're compiling tend to be somewhat different. And some of the planning tools that have come out of them tend to be diverse. It kind of makes me want to footnote, most of what we have at this point is not being of regulatory grade. It's illustrative. It helps us to focus our thinking. A good example is the San Joaquin Valley study and the DRECP.

So I was just going to ask Scott if he could point out some of the differences, just so we keep them in mind and maintain a little humility about what we've got so far, that Scott. You, Scott Flint.

MR. FLINT: So you wanted me to point out some of the differences?

PRESIDENT PICKER: Yeah, just in terms of the data assembled, the quality of the data, the assumptions.

MR. FLINT: Yeah.

PRESIDENT PICKER: I just want to illustrate it. I don't think you have to be comprehensive.

MR. FLINT: So, for example, we have, for instance, the list of species that we may be -- that we're dealing with. Both in DRECP and San Joaquin were selected for -- well, there's different species in different places. But the way they were selected would not necessarily the way you would objectively select them if you were just going to study the area for energy transmission in this way. So we pulled them from other studies. We used what we had. Some things are missing and some things are really good and high quality. Some things are just missing. So that's an example.

DRECP is focused and works on DRECP. Part of that species list was adjusted based on assumptions and identification of DFAs. So you may have some -- if you're in other areas outside of DFAs, we may not have the same information, even for the same species, because we didn't consider that a potential impact or a place that would be impacted in the DRECP study.

So we have little things like this. Those are a couple of examples.

And the agricultural lands is another area. We did our best to evaluate in San Joaquin Valley. We have no evaluation of the different levels of consideration for agricultural lands in DRECP. And that would be both -- that would affect both Imperial Valley areas and the areas in the

West Mojave.

PRESIDENT PICKER: All right. You know, the value of agricultural land is always a troubling one for me, given that we found that some of the existing state regulatory databases were pretty flawed and not up to date. So again, it's one of those areas.

Have you see improvements in terms of our ability to depend on that data, or does it still come down to the individual project and the individual studies?

MR. FLINT: It will come down to the individual project and county. A, the status is changing rapidly in different areas. It's particularly based on water availability and changes related to that. So it's really hard to use a predictive model that really tells you much. You know, we really drilled in for the San Joaquin study specifically on ag, working with the agricultural community and the agencies who help regulate and put that -- regulate those and put that data together. So it really had a lot of expertise brought to bear. And unless you do that, you won't have the same level of information somewhere else.

MR. TURNER: And if I may chime in, one of the things -- I think Scott mentioned that one of the to-dos for the Environmental and Land Use Group is the county outreach. They are the ones that in some cases have done quite a bit with ag lands, for instance, Imperial being a case, and

other places where we are going to remain needing a lot more information.

PRESIDENT PICKER: I might have some very specific questions when we get back to some of the focus area discussions.

CHAIRMAN WEISENMILLER: Well, actually, two things. First, I wanted to welcome Commissioner Peterman who came in while we were discussing this. And I just wanted to at least get one thing in the record, and then pass it over. I have more comments.

But obviously when we sent out the original letter we indicated -- we were welcoming the other states' participation in this activity, although we certainly did not see California as the venue for the West. And so again in that spirit, I'm glad that people are looking outside of the state. But we want to be clear to the other regulatory bodies throughout the West, again, it's sort of a voluntary participation, as opposed to us just sort of starting to plan for the whole West. And certainly this is a good forum for the sort of voluntary discussions.

Commissioner Peterman?

COMMISSIONER PETERMAN: Thank you for the presentations.

Neil, I had a follow-up question on your presentation. Your slides note that the transfer capability

in state at interconnection points may be a factor, a limiting factor in terms of taking advantage of this out-of-state generation. Can you speak more to that point, and specifically what is being done to address some of the transfer capability, and if the analysis might give us further insight about what are the most critical areas regarding that issue?

MR. MILLAR: Sure. Probably one of the key areas people have been targeting for bringing out-of-state resources in has been the El Dorado Substation just inside Nevada. And there is considerable capacity on an energy-only basis. But if we're seeking deliverability, especially from these out-of-state resources, that's an area where there would be additional reinforcement required, especially given that we would be expecting say a reasonable out-of-state play to be in the 1,500 to 2,000 to 2,5000 megawatt range. So that would tend to drive you to some larger upgrades necessary. But it really does hinge on if we can accept some serious level of energy-only resources instead of focusing on full capacity.

The other areas, depending on what they're being traded off with, there is considerable capacity on the Palos Verdes system coming into California from the Southwest. But again, if that renewable energy is trading off with gas resources there's room there, depending on what we're

calling on the resource to do. So that's really where we need to focus, on what exactly is needed from a capacity basis, and then we can transmission plan around it.

CHAIRMAN WEISENMILLER: Okay. I had a few questions to follow up on. The first one was in terms -- I'm just going to make the observation. In Pathways, roughly, very roughly, the incremental load by 2030 in electrifying transportation was roughly offset by, in that case, the energy efficiency calls. So again, it was a pretty rough combination there.

I think in terms of -- Neil, one question is roughly how much curtailment are we talking about when we go to the energy-only approach, again, very rough percentages or however?

MR. MILLAR: Yes. We were seeing some amount. But ironically, most of the curtailment that we were seeing in our production simulation was being driven by the export assumptions, as supposed to constraints within the system. So it was a relatively small amount when we relaxed the export constraint. And I would have to double check. I'm afraid I don't have a good number off the top of my head. I'll provide you that information --

CHAIRMAN WEISENMILLER: Okay.

MR. MILLAR: -- if that would okay.

CHAIRMAN WEISENMILLER: No, that would be good.

The other question is you talked a little bit about how, you know, we're talking about potentially major interconnections into El Dorado, and some reinforcement. How much -- what has to be done from a reliability perspective if we have that sort of transfer capability coming in from out of state?

MR. MILLAR: Well, the one issue for a very large HVDC project moving straight to El Dorado is what happens when that line -- when that project itself trips? So this point we've been looking at needing the system to survive for the loss of the import line itself.

CHAIRMAN WEISENMILLER: Right.

MR. MILLAR: And right now it looks like the TransWest Express Project, I believe, is looking at a staged approach of being with a more modest 1,500 megawatt import to manage the loss of the TransWest Express Project itself as a contingency, and then looking to see if they can move beyond that at a later stage.

Within the system -- or the existing transmission system can work around that level of import on an energy-only basis. But if we're looking to make it deliverable we would either be talking about additional 500-kv transmission or perhaps, and this is a project that's been raised in the past, converting the existing Mead-Adelanto 500-kv AC line that was designed for DC operation to DC.

So there are solutions out there that don't necessarily involve building new transmission but that would be -- when I say new transmission lines but are still a significant cost that would need to be taken into account. But from a reliability perspective inside the state, we would be okay running the energy-only framework.

CHAIRMAN WEISENMILLER: How large could it be before it becomes our single largest contingency?

MR. MILLAR: Right now the 1,500 megawatts is really pushing the boundary for an N-1-1 outage where we consider losing both sides -- or an N-2 where were consider the loss of each pole of an HVDC to be, in effect, a separate circuit.

CHAIRMAN WEISENMILLER: Okay.

MR. MILLAR: But that's where we're getting to that limit.

CHAIRMAN WEISENMILLER: And tomorrow, obviously, Senator Hueso's Committee is looking at the relationship between California and Mexico. And one issue is: Has there been any input concerning Baja in these studies?

MR. TURNER: No, I'm sorry. That's one that we can put some more work into, but we haven't received specific input to date.

CHAIRMAN WEISENMILLER: Yeah. I think part of the issue might be, my impression from the Mexican regulators

was that last year was the first time they did an Independent Transmission Plan that really looked within Mexico. And their intent this year is to look more at the interconnections on the border regions. So this may be an area where we're not going to have a lot of additional information until sometime summer or later. But certainly I think there may be opportunities, again, there to look at projects that cover both sides of the border on upgrades.

MR. MILLAR: Chairman Weisenmiller, if I could just add, I was just provided the numbers here --

CHAIRMAN WEISENMILLER: Okay.

MR. MILLAR: -- that you asked about. What we were looking at from the renewables was with the tightest export restriction we were looking at a seven percent curtailment of the renewable fleet. And it was less than one percent if we relaxed the export constraint altogether.

CHAIRMAN WEISENMILLER: Okay.

MR. MILLAR: And the latter is really more indicative of what you'd be looking at for internal transmission constraints. So we were seeing some, but what we considered a minor amount --

CHAIRMAN WEISENMILLER: Right.

MR. MILLAR: -- of renewable curtailment.

CHAIRMAN WEISENMILLER: Right. Well, we're going to have much more just given the -- depending on the

portfolio --

MR. MILLAR: Right.

CHAIRMAN WEISENMILLER: -- regardless of this issue.

MR. MILLAR: Right. So that showed us that that 22,000 megawatt number wasn't being overly generous. There actually is considerable capacity on an energy-only basis.

CHAIRMAN WEISENMILLER: Okay.

MR. BERBERICH: Chair Weisenmiller, two things. First, let me ask a follow-up to the last discourse.

A complete relaxation is one thing. The six or seven percent number, I forget which one it was, that actually has a fairly liberal export number, too; is that not correct?

MR. MILLAR: No. The extreme case we tested was no export capability.

MR. BERBERICH: Okay.

MR. MILLAR: And that was at seven percent energy-only.

MR. BERBERICH: But that's at zero? Or was that at an import?

MR. MILLAR: That was at zero.

MR. BERBERICH: Right. And right now we normally import about 4,000 today, probably?

MR. MILLAR: Correct.

MR. BERBERICH: So it would be a significant turnaround to get to zero?

MR. MILLAR: Right.

MR. BERBERICH: Yeah. So if -- and keep in mind, much of what California imports, for instance, the hydro out of the Northwest is clean energy, so we need to be -- and, obviously, off of Hoover. Palos Verdes is non-carbon, but we need to be thoughtful about how we handle that, too. I just wanted to make sure that we all were on the same page.

COMMISSIONER PETERMAN: (Off mike.) It would be higher than the status quo?

MR. MILLAR: It would be, yes --

COMMISSIONER PETERMAN: I was just making sure I followed the logic --

MR. MILLAR: -- Commissioner Peterman.

COMMISSIONER PETERMAN: -- that it would be a higher percent curtailment --

MR. BERBERICH: That was what I was trying --

COMMISSIONER PETERMAN: -- than the status quo?

MR. BERBERICH: Right. So we'll have to do some policy making to make that, to shape that.

And you know what, I forgot my second question, so I'll get back to you.

MR. MILLAR: Yes. And I should have just clarified, too. Sorry if I left the wrong impression there.

The approach we had taken was to test through our normal methodologies what kind of curtailment we were seeing, and we were seeing the seven percent range. And we recognized that, well, one thing we weren't taking into account is we were really trying to hone in on how much curtailment was being caused by instate limitations. So we relaxed the export constraint, just to test how much is caused by instate limitations as opposed to intertie limitations.

So that was really the focus of the study. And it really wasn't an attempt to explore the full range of export conditions.

MR. BERBERICH: I remember now.

MR. MILLAR: Thanks.

MR. BERBERICH: I think it's worthwhile spending just a minute talking about the difference between energy-only and deliverable. We're using those terms a lot. I know many people on the dais here know what that means, but I'm not sure everybody on the phone and in the audience knows what that means. And I think it's worthwhile --

MR. MILLAR: Yeah.

MR. BERBERICH: -- spending a minute --

MR. MILLAR: Sure.

MR. BERBERICH: -- or two on that.

MR. MILLAR: sure. Basically, a resource that's considered to be deliverable has been tested through our

annual analysis process to assess that there's sufficient transmission that that resource is reasonably likely to be able to contribute to meeting demand at peak load if all the resources that we're turning to are only the resources that have been determined to be deliverable. So it's a subset of the fleet that is tagged and studied at a system peak condition to make sure that those resources working together would meet peak load.

Energy-only resources are those that are connected to the system that we ensure that they can be reliably operated, but there could be transmission constraints that result in some level of curtailment, either of them or of some other resources within the same generation pocket. So when we're talking about making renewable energy-only resources, they could be accessing the market and getting curtailed some of the time, or other resources, and particularly gas-fired resources within the same area, could be seeing quite a bit of curtailment.

So the curtailment I was referring to was the curtailment of the renewable resources and allowing gas-fired resources to be curtailed through the market operation.

Does that help? Thanks.

CHAIRMAN WEISENMILLER: Yeah. And, Scott, what sort of assessment have we done on the quality of the

environmental databases throughout the West, outside of California?

MR. FLINT: We have just started looking at those, so we haven't really dug into those yet.

CHAIRMAN WEISENMILLER: Has there been any effort by like NREL to upgrade that process?

MR. FLINT: I know both the Western Governors' folks are still working on west-wide data, environmental and biological data. And the WECC folks are -- for the environmental data group are constantly working and upgrading that data. So we want to talk to them to get some insights.

MR. TURNER: I will say --

PRESIDENT PICKER: We know we have some information from the Federal Solar Energy Zone studies.

MR. FLINT: Yes, definitely. Oh, definitely, we have that, yes.

MR. TURNER: I will say it's improved dramatically since the Western Governors Association WREZ, Western Regional Energy Zone, process.

CHAIRMAN WEISENMILLER: Yeah.

MR. TURNER: And moving it over to the WECC/TEPPC, a dedicated group of stakeholders that maintain and update that. It does vary by state to state, individual state context. But the quality of the data overall and the tools

have improved dramatically.

PRESIDENT PICKER: But this is an illustration, both of the value of the federal efforts on this regard, BLM and U.S. Fish and Wildlife Service says it actually provides some of the actual biological data. It doesn't always provide other resource than the solar. But the challenge is that then that predisposes a lot of the siting and the purchasing towards those existing federal lands.

I just had one more question. I think it somewhat builds on Commissioner Peterman's question about deliverability from the California interconnection. And mine is a little challenging, but I think it's important as we look at the success of the Energy Imbalance Market. And I just will notice that I got another email from the ISO today reporting that they've enjoyed about $70 million of benefits from the Energy Imbalance Market throughout the West since inception, about 19 in the first three months of this year.

And so one of the challenges is that while we don't want to plan for the West as a whole in terms of transmission resources, we know that if we want to be able to sell our excess renewables into other markets we need transmission that connects to load centers. And so some of the currently proposed transmission projects are kind of one-way DC deliveries from remote locations without any other value. We can't sell our excess renewable back to an

empty lot someplace in the Northern Rockies. So --

CHAIRMAN WEISENMILLER: They're just gen ties, really.

PRESIDENT PICKER: Yeah. So I think that part of the challenge then, and I'm going to leave this as an open question, is how do we then ensure that we're building a stronger grid throughout the West to serve load centers? And I don't have a good answer to that. I'm just going to put it out there as kind of an underlying nagging question that I will ask over and over and over again about transmission projects that are targeted only towards the California market. I think that's really an artifact of an earlier era when people thought that California wasn't going to build any renewables and that we were in desperate need of projects from a long ways away. I think we're now in a world where we're looking at a much more dynamic western grid.

So you may have thoughts on this from the ISO's perspective.

MR. MILLAR: It's Neil here. Yes, I can provide a few comments. Obviously, that is a complex problem that we're going to have to deal with, as you put it, constantly as we move forward.

One of the main things we were wanting to make sure we adequately explored at this stage is what are the

different benefits of the different kinds of projects out there? You know, even the HVDC projects that historically had had most of the characteristics of a resource driving straight to California have been looking more at various options, including drop-off points along the way at other load centers. Some of the AC alternatives that are being considered also provide more opportunity for bilateral transactions. And that's the kind of information that we want to carry forward as we move through identifying good resources, and ultimately have through some mechanism to decide which of these projects move forward or not. And I think the flexibility you're describing is going to be a key aspect of enabling us to pick which are the better projects as a way to access those resources.

To some extent, though, we've been trying to focus on resources first and making sure that there are viable transmission options. And then dealing with those issues on a secondary basis, once we see if the resources themselves are good for the state to acquire. But that's an important part we have to bring along, and that's why we don't see just focusing on one technology type either.

PRESIDENT PICKER: I recognize that we're not making choices here, but I just want to start building fit notes and some of the principles that we have to underline to be able to make good choices when the time comes.

MR. MILLAR: Exactly. Thank you.

MR. BERBERICH: President Picker, if I could just make a couple observations on that?

I think, one, we're going to have to keep some optionality open because we don't know how the Clean Power Plan is going to progress. We also see RPSs starting to really come to fore, particularly in the western states -- or in the coastal states in the west. And the portfolio effect of those two renewable portfolios I think is going to be critical. And I think it behooves us, frankly, to do some planning with those other states because we can create a win-win opportunity.

The second element of it, from an observational perspective, is that transmission probably is not going to be our major issue if we're to deliver power out of state because we have plenty of transmission capability that counterflows on existing lines. The bigger issue: Will those other states have created the room for our renewables? And creating that room means they will have had to de-commit resources to take the over-generation we have.

I would note, as an example, in Europe, each one of them runs their own market, but they run a common day-ahead market which gets to these issues. And that's how they handle the different portfolios in each area.

CHAIRMAN WEISENMILLER: Just to follow up, I mean,

it's probably one the things which I think there's been a lot of confusion on, on the technical side, is the Energy Imbalance Market, obviously, just deals with that hourly dispatch, period. If you really want to have big effects you have to look more at the sort of regional market approach as what gets you to the day-ahead commitment decision.

I was also going to note, I think to channel Mary for a second, is that the Clean Power Plan is the law of the land. It's been stayed. But certainly from the California perspective we're moving forward, assuming it's going to happen. And at the same point one of the things which, I think when you look around the west, even states without a RPS or with relatively low levels that at this point wind and solar and such best buys that people are moving forward. And obviously, a lot of the other states include large hydro in the mix which, again, has a sign impact on areas, even, again, outside of the traditional RPS context.

MR. BERBERICH: Yeah, Chair Weisenmiller, I can't disagree with any of that. I think that as bulk renewables, particularly, get cheaper and cheaper and cheaper, I think they're quite competitive against traditional thermal resources.

Also, you know, we've kind of touched around a market. I think a market can help facilitate what I'll call

merchant, because they've becoming so cheap, merchant development of renewable resources through the west.

So clearly in California the Clean Power Plan is something that we're going to work on. And I think most -- I interface with a lot of the states in the west, and I think for the most part their intention is to assume that it's going to be in place, and they're going to plan on complying that. So we'll wait and see.

MR. TURNER: Okay. Thanks.

CHAIRMAN WEISENMILLER: Thanks, Brian. Thanks again.

MR. TURNER: This is great. You all are setting up our discussion very well for the rest of the day, really. We've been -- the agenda we've designed is meant to bring you -- bring the whole discussion along these lines. And hopefully the proposal that we'll make to you at the end of the day about the focus areas for the next stage will really address many of the issues that we've raised here.

So next we're going to go into our middle panel which is to review the information that we have learned and discussed regarding what kind of renewable resources may be important for the state by the 2030 time frame to put us on track to the 2050 goals. And to stop talking myself and other staff, and also to bring a more independent perspective. I've asked Hal Harvey from Energy Innovation

to join us.

There's a seat right there for you, Hal.

Energy Innovation has been very active in this space regarding policy that can help achieve greenhouse gas reductions and clean energy, and specifically in the space of reviewing analyses of 2030 and beyond energy scenarios. And I've asked Hal to come and give us some insights based on those.

MR. HARVEY: Thank you, Brian. Thank you.

I'm delighted to be here. I've had the opportunity to work in half a dozen states and a number of other countries on these topics. And it's always a pleasure to do it in California because you're way ahead of the curve on so many things. So thanks for this opportunity.

When I think about renewable energy I often worry that we will snatch defeat from the jaws of victory. As was remarked just now, wind and solar are incredibly cheap. We have the Holy Grail right in front of us, under a nickel a kilowatt hour repeatedly in unsubsidized bids around the world now. But it requires a fundamentally different way of managing the grid and building flexibility into the grid, and that's, of course, the topic today.

What I fear is if we fail to do this collectively, and many jurisdictions are failing right now, renewable energy hits the ceiling, and a very expensive one at that.

So this is an opportune moment to plunge into this.

I want to recognize Sonia Aggarwal here. She runs our project called America's Power Plan, which she's now worked with and made presentations with about half of the public utilities commissioners in America, and done quite a bit of work in China and brought together a lot of utility regulatory experts to bear upon these questions.

Next slide please.

So I've got some slides here. I will go quickly. It's an expert group, I know.

In order to meet California's greenhouse gas goals by 2030, roughly 15 years from now, we have to reduce by approximately half the amount of fossil energy on the grid. That seems like a lot. But put in another context, fossil energy is only about half the energy right now. And if you divide -- if you reduce that by half and divide it over 15 years, it's a little less than 2 percent per years change swapping fossil for renewables, but also making up for growth. So it's a reasonable pathway.

Next slide please.

The word I will use again and again today is flexibility. We're moving from a world of dispatching resources to meet independent demand to a world of optimizing demand, supply, transmission, buy, sell, generate, all against each other. System optimization is,

in my mind, the watchword. System optimization requires both physical changes and institutional changes, because if you don't have the ability to move electrons easily you can't optimize. Similarly, however, if you fail to adjust your contracts and institutional settings, the thing will not work.

Variable renewables is actually a heterogeneous quality. There's known variability, which is daily or season trends. And there's a lot of things we know 24 hours in advance, and some things we know years and years in advance. And then there's unknown ability which tends to be short term, like the wind dying down or clouds coming in. There's a third kind of variability which you might call unit size variability when SONGS goes away or when Aliso Canyon has its troubles, you can take out, with certain power sources, very large fractions of the grid.

Next slide please.

When you read in the popular media about how to deal with variability the answer everybody seems to come to is storage. For every kilowatt hour of -- or kilowatt of supply we need a kilowatt hour of storage. We have ranked here half a dozen approaches to meeting the variability challenge. Storage is the most expensive of them all. Actually, curtailment is even more expensive than storage, most likely. What I'm going to do today is walk through

each of these with a couple suggestions and then put them together. I know this is a grid-focused conversation and grid is what ties it all together, and I'll spend most time on that

The first of these -- the next slide please -- is improved operations. And the discussion has already been raised: Can we expand the Energy Imbalance Market? Can we expand it, both in terms of geographic scope and the number and type of products that it offers? And can we change imports in a useful way, and export rules? In other words, by a stroke of a pen can we expand flexibility on the system? And there's a lot we can do on that front, and I think we should pursue that vigorously, both independently as a state and emphatically in concert with our neighboring states.

Next slide please.

There, I just said all that. There really is a rich opportunity here to expand flexibility.

Next slide.

This is a picture in late March of this year of a time when we had excess renewables in the red that we were curtailing. And at the same time, in the light blue, we were importing energy. So I'll submit to you that that's not a good strategy, importing at the same time that we're curtailing. That's an example of improved operations that

can be fixed pretty much with the stroke of a pen. I don't want to minimize the physical side of it because it's there, but this is a fixable problem.

Next slide.

Demand response is, in my opinion, a booming field. And we have absolutely no idea how big it's going to be, how rich it's going to be, and the variety and type and quality of resources it's going to deliver. But if you look at the advent of advanced sensors, cheap telecommunications, big data, and the opportunity to open new markets, there are huge opportunities to manage demand just as we manage supply. And it's very cheap because fundamentally you need radios and sensors to run a demand response, you don't need turbines.

Next slide please.

There are, broadly speaking, two kinds of demand response, one is physical control of load centers, like Nest is allowing you to manage a million houses all at once, and the second is economic control where you offer variable time-of-use pricing. Both of these can be done at the same time. I would encourage the State of California to expand both kinds of demand response and to expand them both at the utility level and at the ISO level.

This is a supply curve for demand response for California. It shows 6,000 gigawatt years [sic] of demand

response at under the cost of operating single-cycle gas turbines. So that's, again, essentially free. When PJM opened itself up to demand response bid they came in at more than 80 percent cheaper than the supply-side bids. So it's a huge resource to balance the variability of renewables.

Next slide please.

On to grid. We've heard a lot about grid already and we will hear some more. The grid, of course, enables all of this and much more. I've got a few slides I want to walk through here, but you can optimize several things at once with the right kind of grid. You can optimize cost savings, carbon reduction and reliability all at the same time with the right investments in grid.

Next slide please.

So this is a picture of variability of wind turbines, 15 of them in the top, and 215 in the bottom. And as you can see, just hooking up more of these similar units dramatically reduces their variability, so that's one kind of example of how you can deploy the grid across a variable of renewables to get a very nice supply curve.

Next slide.

This is from a Scientific American article, so it's hypothetical. It's showing a way of dispatching hydro to make up for variable sunshine and wind, straightforward conceptually. You could argue that the biggest cheapest

battery in North America is Bonneville Power System; right? Think of it as power instead of energy, and make it available to dispatch. There's a lot of value to be had for both the Pacific Northwest and California for this kind of optimizing across different resources.

Next slide.

There are also great geographic diversity benefits available. This slide here shows Wyoming wind capacity factors and variability as the green line on top, California wind at the bottom. And there's two things that are important here. One is, obviously, the different capacity factors. But the other is their availability is negatively correlated. So hooking them up together gives you a much more consistent overall supply resources. Again, it's a very nice way of managing long-term variability.

Next slide.

This is a little hard to read, but let me summarize it with about two sentences. This is two resource cases, one emphasizing solar, the other emphasizing a diverse resource mix. And the punch line here is that the diverse resource mix costs less and has less carbon. So by optimizing across a suite of clean energy technologies you build more flexibility into the system.

As you can gather, the point I'm trying to make here is that if we do a number of things together and do

them with system-optimizing markets and system-optimizing institutions, we can easily get to 2030.

Continue please, next slide.

Fast ramping natural gas is the next on this hierarchy of cost and so forth. What I say nowadays is use gas for power, not for energy. Gas turbines in America run at about a 50 percent capacity factor. We don't need to build anymore ever. Turn them on when you need them and turn them off quickly, and run them for very few hours a year, and they provide a lot of system value with a very significant carbon footprint. So power, not energy, is I think the future for gas. Building more gas is emphatically contraindicated if we're trying to reach a reasonable greenhouse gas future. And for those who study methane's impact on greenhouse gas warming, there's a strong argument that gas is not better than coal, substantiated by a lot of science right now.

Next slide please. I mentioned that. One more please.

Energy storage. California has led the way in creating new energy storage technologies. I think your docket mandating that the three utilities purchase energy storage is a great step forward. It's the kind of things that breaks open new markets. And I think we need to continue pushing it, and I think there are more

opportunities to push it. So I don't mean to denigrate energy storage in any way. I do take objection to those not here but in the New York Times and other places who are argue that you need storage in order to move to a higher renewables future. It would be great. It's not required. Batteries not included, I sometimes say.

On to the next slide please.

This is part of the Low Carbon Grid Study looking at total costs, comparing curtailment with enhanced flexibility and conventional flexibility. And the point here is simply if you build flexibility into the system through this suite of options that I've mentioned, you dramatically cut costs and you don't need much curtailment.

Next slide.

There's a whole other realm, however, which is unexplored and little mentioned which we've listed here as long-term elasticity. The fundamental problem of excess of curtailment is you have too many zero-cost zero-carbon electrons, and I would call that a high-quality problem. That's what we need in the world. And there are a whole bunch of business ideas and, indeed, businesses that are increasingly designed around that concept. I'll mention a couple from here.

Data processing worldwide now uses as much electricity as the United Kingdom, probably more, because

that was three-days-ago data. And you can move data very quickly and very inexpensively through fiber optics. Fiber optics cost about one percent per mile the cost of copper. So you can wield jobs instantaneously instead of wielding electrons very cheaply. It's just one example.

There's other more conventional ones like air gases which have very low capital costs and very high energy costs, so set them up to be the offset to curtailment.

Desalinization. It's been remarked that water storage is cheap, and it is compared to electricity storage. So if you have a desal plant that load follows, you have opportunities. I have no idea how this field is going to unfold. But I predict, just like demand response, that if the prices are set properly and some longer-term contracts let, there will be a huge creative and interesting use of what would have been curtailed electricity.

So next slide please.

If you put this all together you end up with a system which is simultaneously more reliable, cleaner, and more affordable. That's what you get by optimizing across resources.

I want to offer four examples here on this, so one more slide please.

This is Arizona's version of a duck curve. Their current net of solar load is the gray line that's modestly

wavy. Their projection for 2030, roughly, is this purple line. And they have to ramp up about 3,000 megawatts over 8 hours, which is a lot for a state the size of Arizona. Arizona is an hour earlier than we are. We're going to have excess solar right when they have this deficit. So there's a great opportunity.

And to your point, President Picker, we need to think of our transmission grid as a two-way street, as a system-optimizing street. And we need to continue to push open markets in other states. There's fantastic opportunities there.

Next slide.

We're in the middle of retiring the entire coal fleet in America. More than a third of it has been scheduled for retirement, and the balance, I would guess another half of what's left will be retired in the next 15 years. A lot of coal-fired power plants are going to be sitting next to little-used or almost unused transmission lines, and yet they're near significant wind resources.

And so this is a snapshot, it's hard to see, but of parts of New Mexico and Colorado where there are coal plants scheduled for shutdown. There are transmission lines, and there are significant solar and wind resources. So as we proceed with regional power planning it would be wise to suggest to our colleagues in other states that we're

quite interested in helping them solve this problem. And we can bate the trap a little bit by offering some long-term contracts when appropriate. It's amazing how fast things can be resolved when there's financial certainty behind them.

Next slide please.

We also mentioned, and I want to use these next two slides together, connecting negatively correlated resources. If we consciously decide to have stronger interties with the Pacific Northwest and with the wind in Wyoming, and with summer-peaking states to our east but in different time zones, there are very significant economic advantages for both directions. It's classic mutual advantage.

And then my last slide please.

What this all requires, amongst other things, is in thinking through our transmission lines, thinking through a way to optimize across the whole. And I would emphasize here the opportunities for building networks and loop systems. You can build a lot of reliability into the system. This is a slide here showing a new north-south connection along the eastern half of Nevada, the Southwest Intertie Project. This helps solve reliability problems within California because you can reroute electricity if you have problems within California. So it's not just bring

Wyoming wind to California market, it's emphatically, if it's properly designed as a way to increase reliability within California itself.

Let me just wrap up with a couple comments. I'm sometimes befuddled with the complexity -- I'm always befuddled with the complexity of the electricity regulatory system. There are a lot of things going on at once. And that happens at the Public Utilities Commissions, and it happens at the FERC, and it happens in the operational work at the ISO, never mind all the siting issues, natural resources issues and so forth.

I would submit to you, though, that this state is better equipped than any jurisdiction I've ever met, I've ever encountered to begin to think in terms of system optimization. And there are opportunities to build markets, like demand response markets that kick-start system optimization. There are opportunities to reregulate utilities so that they're motivated by affordability, reliability, and clean, rather than by throughput. I mean, we don't do throughput anymore already, but rather than by the sort of mix of cost-plus incentive regulation we have.

And certainly as we look to build an expanded transmission system, if we think about it as a device for optimizing the whole and we build it physically toward that end but also institutionally contractually toward that end,

we can arrive at levels of renewables projected for 2030 but also well behind at no incremental cost, compared to today's BAU.

So thank you.

CHAIRMAN WEISENMILLER: Thanks. Let's start with a couple questions.

The first one is, you know, when you look at say the German experience, Agora is very clear that the cheapest form of storage is the grid --

MR. HARVEY: Uh-huh.

CHAIRMAN WEISENMILLER: -- west-wide. And so that's, you know, again, a metaphor. I guess they found the most expensive to be power to gas --

MR. HARVEY: Uh-huh.

CHAIRMAN WEISENMILLER: -- you know, in their list. So again, I think that part of it's easy.

They also are looking now more at some of the black swan events. And you live in San Francisco, so you know that when it's peak, we have no wind.

MR. HARVEY: Right.

CHAIRMAN WEISENMILLER: You know, and so one has to -- you know, so there's some smoothing if you have one wind farm. You've got a real backup problem if you have ten. But at least, as long as we continue to be, you know, geographically focused on California resources, wind is not

going to be particularly valuable during the peak periods. Certainly, the Germans have their analogs of when the black swans occur.

MR. HARVEY: Yes.

CHAIRMAN WEISENMILLER: But that's something that, again, as we look at resource diversity we have to consider what are some of the extreme events that can occur and not just smooth it over.

Similarly, location is important for resources.

MR. HARVEY: Yes.

CHAIRMAN WEISENMILLER: You know, again, it may be that we have a lot of gas plants, but not in the right places at this stage.

I think the one thing as we go forward, certainly -- and I guess the other thing from Agora is they've generally found demand response to be not that significant, potentially, in Germany in terms of they have a lot more industry in California, but it's not that responsive. It could be like President Picker has some interruptible customers who sort of moan if they ever thought of being potentially interrupted.

MR. HARVEY: Exactly.

CHAIRMAN WEISENMILLER: You know, so again, you know, I think a lot of these things, trying to translate the conceptual stuff into what we can actually get in terms of

megawatts is hard. You know, similarly, you know, we would love to figure out a way to get DWR much more into the demand response market. It's just we've given up, you know, I'm afraid.

MR. HARVEY: So let me start with demand response, and then a word or two about black swans.

CHAIRMAN WEISENMILLER: Okay.

MR. HARVEY: So there's a difference between interruptible rates and a full-blown demand response market. And I think you're right, you know, interruptible rates, people get a sense of entitlement, I'll never be interrupted since I wasn't for the last few years --

CHAIRMAN WEISENMILLER: Yeah.

MR. HARVEY: -- so leave me alone. It's possible that setting a time-of-use market price will help this quite a bit.

I actually think that a better way to do it is for the ISO to define the qualities it needs to maintain reliability in terms of ramp rates, in terms of response time, in terms of assurance that it needs that it's going to happen, and open up a bid to all comers, supply and demand, and see what happens. And you don't have to start with an all-in market. You can start with a small -- if you think you need X amount, start with ten percent of X and see what you get.

One of the things, however, is for these kinds of markets to work initially, I think you have to offer fairly long-term contracts because people have to build a new business model around it. You can ask them to bond their performance so you don't get fly-by-night operators. There's a lot you can do to assure that it works. And the ISO can test it, as well. But if you offer a long-term contract on a competitive bid for a highly defined product and you get what you like, you can repeat the bid, the option. If you don't get what you like, you can tune up the auction and run it again without violating the sanctity of your first set of contracts.

So I would maintain, we're just scratching the surface there, even though there have been these time-of-use or these interruptible rates failures.

CHAIRMAN WEISENMILLER: You know, after the SONGS, one of the things we were pushing for, it was the ISO was talking about potentially doing a competitive bid process for DR to move along. And just institutionally, we could never get past the two agencies on that question.

MR. HARVEY: Well --

CHAIRMAN WEISENMILLER: You know, it stayed in sort of Demand Response 1.0 or whatever.

PRESIDENT PICKER: And out of our great fear of FERC at the CPUC, we tend to demand that we actually conduct

the processes for defining resource adequacy. So I think it kind of works against that, and we tend to then have a difficult time trying to reach a broad agreement on what those DR qualities are that we want to achieve. And it usually looks like the existing contracts that the suppliers already have.

MR. HARVEY: So those are tough questions. And this can be done at the utility level. I think the FERC has been pretty kind to PJM on this matter, and the Supreme Court upheld their power to run this side of it recently. So, I mean, again, you can run experiments at a fairly low cost and see what you get.

Just a word or two about black swans. This is, of course, front and center for all of you in thinking. I was just talking to a friend who works in Japan recently. You know, of their 43 nuclear reactors, only three are back in operation. So that's a big bad black swan that they've had to deal with, and they've dealt with it. So there is resilience. It's obviously not what you want to test.

But again I would argue, if you have a rich transmission network, a variety of resources and the ability to optimize supply against demand, you've actually mitigated the possibility of big black -- of black swans hitting you hard.

CHAIRMAN WEISENMILLER: We're already seeing a lot

of our solar is in Southern California, a lot of it's coastal.

MR. HARVEY: Uh-huh.

CHAIRMAN WEISENMILLER: So we have, you know, the sort of June gloom and/or the monsoons really having effects. We used to have dramatic impacts on wind dropping or falling in the ISO grid. Now it's much more the solar.

And so again, I think part of it gets back to this notion of regional markets would give us more east-west diversity. But at least at this stage, we have a lot of our solar systems along the coast. And just given the nature of our geography means that depending on whether the clouds are in or out, or whether we have a monsoon, it's going to be on or off, you know?

MR. HARVEY: Fortunately, air conditioning sort of follows that same --

CHAIRMAN WEISENMILLER: Exactly.

MR. HARVEY: -- load. Yeah.

CHAIRMAN WEISENMILLER: Yeah.

MR. BERBERICH: Yeah. I think your slide that showed the smoothing effect of diversification, geographic diversification is very powerful. And I think, I mean, it's almost like you stole one of my speeches because I think all of these are the right things that we need to do, because I agree with you, you will hit a wall at some point. And I

think we have a lot of opportunities at our fingertips to do this cost effectively while doing this to reach a new clean future, so I think we need to seize those opportunities.

I would also argue that you can get a whole lot of benefits -- you know, I've got all kinds of scars about demand response. Michael Picker talked about them just a bit. But I will say that I think you can get a large percentage of the value simply by having a good smart time-of-use product. And I think that we have good general alignment around that. And we've done some studies around that, the ISO has, around our ducks. We did a flock of ducks. And you need about four of them. And most of the year you only need two to get most of what you need. So I think the opportunities are great.

MR. HARVEY: Yeah.

CHAIRMAN WEISENMILLER: I don't know if anyone else saw the UC Berkeley announcement today, "The Duck has landed?"

MR. BERBERICH: I look forward to seeing that, Chair Weisenmiller. Well, I'm curious as to where the duck landed.

CHAIRMAN WEISENMILLER: California. They sort of pulled together the March numbers for the loads. Yeah.

MR. BERBERICH: What you're saying is the duck is here? Oh, yeah. If you go down to our control room in any

afternoon you will see two things. One, you will see the duck in progress, and you'll see persistently negative prices for hours on end, so which is just like we predicted.

MR. HARVEY: Which is, yeah.

MR. BERBERICH: But, you know, I will say this, Mr. Harvey, I think your point is well made, and I don't want to lose this point. While we're all concerned about over-generation, I think, or even excess supply, there are lots of ways we can deal with this. And I think if we're smart about it, nearly free clean power is a good problem. And I think it's a good problem, not only for us, I think it's a good problem for the region. And I think acting that way, we can really decarbonize the system.

COMMISSIONER PETERMAN: I'd just like to make an observation which others have touched upon in various venues. But what struck me when listening to your presentation, which I thought was very interesting, thank you, was that in terms of the supply curve for the supply curve for flexible resources, it might be ordered different if we were making the axis regulatory and political ease. And so, too, so that's got me thinking, well, a couple things.

One, have you or are you aware of any work that's then taken this curve and then reevaluated based on those considerations? Because you've heard that there's various

reasons why certain things have moved forward or not. And even the reference, the Supreme Court decision, it just shows you how much in flux some of these issues are.

But kind of one or two, a couple questions.

Which of these supply curve options have you seen, perhaps the most movement on, because that might signal that we have a regulatory or political system that is able to make changes in an area? And if there are -- also, if you have identified the biggest regulatory barriers to getting some of this lower cost resources options made available to us, things that we can -- we really need to start working on? Thank you.

MR. HARVEY: Those are tough questions, Commissioner Peterman. Just -- well, no, I'll just take a couple quick swipes at it.

I know that on the DR supply side there's quite a few interesting companies that have made very significant bids in Texas and in the PJM market. And there's other, like ChargePoint and Nest here in California, who are accumulating a lot of customers so that they can have a single-points sales to you.

I think one of the issues, and this is a tough one for California, is California PUC has lots of issues. And then with each issue it has analytics and rules and staff, and then utilities develop a practice behind that; right?

And so there's an accretion of energy efficiency programs and storage programs and supply programs and cost recovery programs and nuclear programs and so on, and it's hard to see right through to a performance-based standard when you have all that stuff.

I guess the suggestion I would have is to carve out a piece of something. It could be the residential sector in San Diego or part of a small subset of that. But work with a utility commission -- sorry, a utility CEO who wants to do this and say we're going to give you five years of running room to pursue as much DR and as much DG as is cost effective and energy efficient to your customers. And we're going to reward you for performance, and we're not going to look into your books at all. We're just going to do an X-plus facto of how much kilowatt hours and how much Co2. Less on both is the right answer.

And again, I know it's hard to tweak the reforms in that pile of regulations and pile of habits. So I would look for a piece to do an experiment in and push that very hard.

PRESIDENT PICKER: Well, we did that experiment in the load constrained area around San Onofre and we got some good results. And so I think we're trying to do that in terms of our integrated resource planning process. And the big obstacle, that while we did get permission and direction

from the legislature to pursue a procurement process built around an integrated resource portfolio, built around a greenhouse gas declining standard we still have these other preexisting statutory requirements to procure from 85 different kinds of contradictory technologies at levels that --

MR. HARVEY: Right. Right.

PRESIDENT PICKER: -- more than supply needs in some areas, and totally miss needs in other areas. So anything you can do across the street would be helpful.

MR. HARVEY: Well, I mean, again, this collection of leaders in California, I promise you, is unmatched in any jurisdiction. You've got all the agencies here and you are all incredibly deep substantively driven and have great staffs. And so I think if you come together and say here's a strategy to take advantage, here's a strategy to build two-way flow, here's a strategy to take advantage of demand response, it doesn't have to be full-blown grand bargain type of stuff, but it could be two or three bold steps that you all agree on. I would wager you could get that done.

COMMISSIONER PETERMAN: Well, okay, appealing to our excellent capacity goes a long way, so we'll work on it. Thank you.

MR. HARVEY: And we stand ready to help. No, seriously, you know, I will say this, California has to

succeed; right? There's no other jurisdiction that's going to push this hard if we fail. And Germany has done some brilliant things, but right now they're making a hash of it. So it's time for California to own this.

CHAIRMAN WEISENMILLER: Well, you know, I think the Air Board, if you look at the most recent statistics, the greenhouse gas numbers for the UEG sector are 20 percent below 1990, which is certainly a different story than Germany.

MR. HARVEY: Uh-huh. Yeah. Yeah. So --

CHAIRMAN WEISENMILLER: Thanks.

MR. HARVEY: Thanks very much.

CHAIRMAN WEISENMILLER: Thank you.

Next, Brian.

MR. TURNER: Well, great. Now we're going to turn to something a bit more prosaic, I'm afraid. And this is -- and it's a thick deck. So, actually, I'm going to try to skip through it pretty quick. But this is meant to be what have we learned from stakeholders during RETI 2.0 about where the resources are that may help us meet those 2030 goals.

Next slide. Next slide again.

So this is -- we're still on the first box here, but we're moving beyond it. I'm using this as a springboard to get into what's our end-of-the-day, identify the high

value resources that may need transmission.

Next slide.

Context and caveats. First, let me say that this is all non-regulatory grade information. President Picker already alluded to this. This is a non-regulatory process. It's really kind of visioning, where are the resources we might need? It's extremely hard to summarize the information that we learned. We're summarizing and synthesizing this input. This is not a comprehensive supply curve of resources by any means. Furthermore, it's pretty high level. We're looking at where are the large pockets of resource that may make sense by 2030. We're not exploring explicitly distributed energy resources, your community solar, rooftop solar, et cetera, though that does impact those planning goals that I discussed earlier to a large degree. But we're not looking at the transmission needs for that.

Also, we're not looking -- generally, biomass has not come up. I'll touch briefly here in a minute. New hydro has not come up at all. Solar-thermal, there's been some discussion but it's not a major focus. Similarly, grid storage, it has come up, there are projects out there that matter and are important, but I won't be touching on those specifically in this deck, though I think it is an important resource for us to consider to the extent possible. We have

gotten some information to that effect and we will be looking at it. But offshore wind and other really emerging technologies, also not in the picture of what we've received information about.

And I'll use this as an opportunity to say, all this is draft information. We're seeking comment on it, not just presenting it to you but presenting it to stakeholders. So folks that have a strong objection to what I'm saying, I hope you'll let me know.

Next slide.

So the process that we went about to gather this information, we held two workshops and comment periods, the first on March 16th. There's a series of questions there. It was really about what's the latest and greatest on the costs and values of different renewable resource areas. Back in 2008 to 2010 we did the RETI 1.0 process that was very comprehensive, and then the Western Governors did the Western Renewable Energy Zone process, very comprehensive where the renewable potential and what does it cost. And we've kept very updated on that in the institutionalized process, including the CPUC's RPS calculator.

But we wanted to revisit with stakeholders and say, what are we missing? And furthermore, what's the interest of the real players in this space, the utilities and the developers of resources? Where you looking to

either acquire resources or to develop resources? How should we be taking that into consideration?

And then on April 18th we did a workshop that was really looking at the 2030 scenarios, about what does a portfolio of resources look like that can help us meet those -- be on track to meeting the 2050 goals, and what does that tell us about the individual types of resources that we'll need to look for. And much of this is similar to what Mr. Harvey just presented.

Next slide.

But I'd like to -- oh, first let me -- here's a long list of the very generous -- people that have been very generous with their time to be involved with the process and present to us either in our workshops or in comments, relevant information. But the list could be much, much longer. There's just so much information and such an active industry.

Next slide.

I want to start off by talking about the 2030 study. So it's a little backwards but it helps us give some priority to the discussion of different resources and some context to how we might look at what resources might be important by 2030.

Next slide.

We looked at a few different studies. One has

already been mentioned. I've just got one slide on the Low Carbon Grid Study. This was one done, performed by National Renewable Energy Laboratory at the request of the Center for Energy Efficiency and Renewable Technologies and their many stakeholders.

Hit next slide. Next, and next again. There we go. All right.

I just wanted to circle a few of the main conclusions here. It's a fascinating study and quite extensive. Up to the upper right there, you'll see the different portfolios that were studies. There were several different scenarios, but there was basically three different scenarios, a baseline, a target scenario, and then a high solar scenario. So much of these conclusions compare that target with the high solar just to compare.

What I'd say is high solar is our trajectory course. Solar is so cheap now, it's been the major source of procurement in recent years and in foreseeable years to come. And so what does that look like, compared with one that includes more technology diversity.

And the first critical components of enhanced flexibility there, I circled technology and geographic diversity of the different kind of renewable resources coming from different areas that have different generation profiles. We've already hit upon the benefits of that.

Let me skip to the other circle that -- oh, no, sorry. Go back.

I just wanted to highlight how the diverse, or that's also knows as the target, scenario does reduce cost and reduced curtailment, but also other sources of flexibility do, as well. And I want to make sure that I'm highlighting that there are many sources of flexibility here, ways to integrate either solar resources or other resources. Having a diverse portfolio is one of them. It may not be sufficient. You see that even in a diverse portfolio, if you're using conventional flexibility means, like less interregional sharing of resources or optimized markets, then you're still going to have curtailment or higher costs, whereas if you've got a diverse portfolio and other flexibility measures, that's where you see, really, the lowest curtailment or lowest cost overall.

And that's really some of my very quick points from this study that I pointed out.

Next slide. All right.

This has quite a bit more information. And this is based upon the CPUC's RPS calculator, and specifically drawing some lessons from an analysis that was completed back in March, looking at 2030 portfolios. And these were not optimized portfolios. These are not anything upon which procurement decisions are going to be made. But it was a

thought exercise to see what kind of lessons could be drawn, looking all the out to 2030. And I'll point out some of those.

Click ahead.

The first one is on either the default scenario or you'll see environmental baseline there and DRECP/SJVP. Both the environmental baseline and the DRECP/SJVP are examples of environmentally preferred scenarios. In both cases you'll see that more solar is selected in state. And in the absence of other flexibility mechanisms you get this relatively high curtailment scenario.

By the way, I'll point out the megawatts here are not really -- they're based upon the assumptions of what load would be for the ISO territory in the CPUC's scenario, so that's not really what I wanted to point out here. It's just the different scenarios of where you're selecting the resources, and that's one of the environmental preferences here, suggest that you're going to be going to places with more solar resources and that that could lead to curtailment.

Hit the next again.

And then I'm skipping down to discussion of instate wind and geothermal. In both of these you see that the higher capacity factors can lead to lower overall procurement, as well as the EO and WECC, sorry, that's stand

for energy only in a west-wide context, can also lead -- those three lines represent some of the lowest overall need for renewables amongst the scenarios. And so you're seeing that high capacity resources can lower your overall capital requirements.

However, I'll note next to the geothermal there that it, in this scenario, requires, given the assumptions in the RPS calculator, requires some of the most transmission. And that may be one where this process can add some detail or more information.

One more circle coming. There we go.

So this is highlighting the high battery-electric vehicle, that's the BEV, in an export scenario and a storage scenario. Each of these present, somewhat, somewhere to go with your over-generation, and they each have different implications. One is that even in a high BEV, you might end up with quite a bit of curtailment.

Actually, the main point that I wanted to make here was that the exports seems to lead to the lowest curtailment and lowest cost overall, the storage and battery-electric vehicles help with both of those, the BEV on a per-kilowatt basis because you're increasing total demand overall, so you're spreading out the costs over a broader area.

So once again, just pointing out that there's a

variety of means to -- a variety of portfolios that could meet 2030 goals. They have tradeoffs. Some are higher cost, lower cost, et cetera. But some of the enduring insights may be that exports and portfolio diversity matter a lot.

Next slide.

Oh, and this slide is another one taken from one of those sensitivities. And I think of this slide as presenting much of the rationale for RETI process overall.

First, let me start you off with the gold and blue bars are. They're illustrating how the RPS calculator predicts that procurement would occur on a year-by-year basis, how much wind would be procured versus how much solar. Then I'll also point out, the red line that goes down is the effective load carrying capacity, really the capacity value of photovoltaic, how much -- how do you describe that -- how much sureness do you have the load will be served by an incremental unit of more photovoltaic. And it goes down dramatically as the overall amount of solar PV that is all generating at the same time goes up. Whereas the blue line, which is the wind capacity, ELCC, remains fairly constant. And you'll also see curtailment going up, the gray line towards the latter part of the period.

So the calculator, which is an optimized selection of resources on a year-by-year basis, you'll see that as

those costs of curtailment go up the value of PV goes down over time, that there's a sudden switch, relatively sudden in the early to mid-2020s when the calculator wants to select all wind because the value of an additional unit of PV has dropped dramatically. Now this is just one scenario and, as we just discussed, there's many other things that mitigate this effect. But this is one example that if we were to find ourselves in that situation and not have sufficient transmission capacity to good wind resources, then we're probably going to be finding more expensive solutions than we would wish for.

So, to me, this is just one -- it's a good data point overall about what kind of resources may be a priority for 2030, and a good rationale for why this kind of forward-looking planning is useful.

Next slide.

I wanted to briefly touch upon this. It was another model that we brought in that looked at long-term portfolios. The focus of this is really the environmental preference. And when -- the conclusions that can be drawn about where resources are best developed, given different environmental and land use assumptions, the Nature Conservancy has constructed a model that applies various land use screens, and then drawn some conclusions about where resources will be developed if you were to screen at

different levels.

Hit next, and next again.

The first circle there illustrates how wind resources, which is to the left, the graph that's declining, go down as you're increasing the stringency of your land use screens, that the wind areas in California are being screened out more. And then just to the right of that is where the graph is increasing. That's showing how increasing stringency of land use screens means that you're selecting for instate resources, more solar.

Then if you go all the way to the right, these are illustrating -- that small circle is illustrating what happens in a west-wide scenario. As you're increasing land use screens, you're using less instate California land overall and selecting more resources from out of state.

So one conclusion that emerged from both the RPS sensitivities, as well as this work by the Nature Conservancy, is that increasing land use screens means either selecting more instate solar or more out-of-state wind. And that's potentially an area where we could add more in this process, is evaluating the wind resources that are available in state.

And another recommendation that the Nature Conservancy made was built on what we know, build on what we've done. That's why the big circles on the DRECP area

down there in the southwest -- southeast of California and the Central Valley, the San Joaquin Valley Solar Study saying we've done a lot of land use and environmental work here, let's build off of that.

Next slide.

So now I'm going back to more of the basics of where the resources are in California, and then I'll hit on Westwide.

Next slide.

So solar resources. The big story here is dramatic success. The solar industry is doing very well. The technology that they have innovated has seen dramatic improvements, so much so that really solar power is widespread, good quality throughout California. Low cost solar resources are nearly ubiquitous in California. The cost reductions, according to Lazard's levelized cost of energy estimates, late 2015 have reduced by 82 percent in 6 years, down to some very low PPA bids or LCOE. In fact, so much so that the most expensive is less expensive than the best RETI 1.0. The worst area for developing solar PV in California now is less expensive than the best solar resources were just six years ago when we did the RETI 1.0 process.

And one downside of that, though, you'll see at the bottom, back when we were evaluating RETI 1.0 and

imagined a lot of solar thermal all over the place, solar thermal has not seen as dramatic costs declines and so is not nearly as competitive as solar PV.

And one of the things that we heard repeatedly from stakeholders was the improvements that have been made in the PV capabilities in terms of grid support and their ability to add to operational flexibility.

Next slide.

Instate wind resources. So there is high, a relatively high technical potential wind in California, but it's concentrated in a relatively smaller amount of areas statewide. And I will make pains to mention repowering multiple times during the day, it's not something that we've considered as having significant transmission impacts if we're thinking about new transmission, but it is one that instate wind is very interested in repowering of existing sites.

Hit next.

This is circling various areas that in red are ones that we're going to propose taking a closer look at. Many of these are already known. Certainly, the southeastern resources, Imperial, Victorville, Tehachapi, Tehachapi being one of the large success stories from RETI 1.0 and of the past six years. And then -- and to some extent Solano, as well, but then becoming lesser well known

as we move north through the state.

And then some of the areas circled in purpose are areas that for various reasons, whether it be local opposition or less commercial interest, we're not proposing to follow up on much during this process. And I'll have more to talk about that in just a minute.

Next slide.

And then geothermal and biomass, geothermal is located in very few areas around the state.

Hit next.

There they are. Really, where's there's commercial interested coincident with more geothermal potential, Imperial Valley, Owens Valley and Modoc, probably in that order in terms of the extent of resource. The costs are very site specific and subject to considerable dispute and discussion and evolution of the understanding of the costs and values. Geothermal does have a very high capacity factor which makes it quite attractive, and potential flexibility, though probably expensive flexibility. But we did hear quite a bit about the flexibility of some types of geothermal resource.

And then biomass, which is very dispersed across the state. The little green dots there are existing biomass facilities. There is a lot of interest in biomass energy now, especially with the tree mortality crisis that the

state is facing. But as far as the information that we've received to date, that is focused on existing biomass facilities and is not discussing very much new facilities that would require new transmission. So that's our conclusion to date.

PRESIDENT PICKER: Commissioner Peterman apologizes for having to leave. She's actually at a meeting to talk about those conclusions.

MR. TURNER: Next slide.

So then the western renewable energy potential, and you probably have seen this slide before it came out of the Western Renewable Energy Zone Project, but it presents a good overview of where the resources are generally. And there is a lot of interest, a lot of development going on around the west. A lot more for us to learn, frankly. We have not had as robust participation, and I'll have some recommendations addressing that. But we know that there's active development in solar in Arizona and Nevada, quite a bit of it building off the work that's been done by BLM and our federal partners to designate solar energy zones there, and even interest in selling into California from those energy zones.

The wind resources in Wyoming and New Mexico, we've heard mention of them already, they are world class, high capacity factor resources that, if we can access them,

do seem like a very good match for California's needs. Colorado and Montana have some, as well, but they're more remote.

And then geothermal, we have heard quite a bit about the Northern Nevada resources, and a little bit there in Southeast Oregon. And those are ones that we will definitely be taking a look at.

Next slide.

I'm going to go on a whirlwind tour of some of the commercial interest information that we heard.

Next slide.

First, laying some groundwork on what's our current portfolio of renewable resources in California, there's that figure of 21,700 megawatts installed capacity currently, including the self-generation. And it's a little hard to see on that graph, but if you go all the way out to the right you'll see the dramatic increase in wind, much of it in Tehachapi Region. But then at the very tip you'll see solar taking off and the wind really kind of starting to decline. And if we pushed that out even further, that alligator mouth of solar, that increasing triangle would just be quite steep in terms of what's been signed in the past year or two.

Next slide.

So we heard from each of the utilities about how

they go through evaluation process. And to the right there is an example from Southern California Edison about their evaluation process, and it includes the four factors to the left which come from an E3 regarding the challenges of integration of different renewable types. It's most pronounced with solar, that as you increase the amount of a particular renewable resource, when other resources are correlated with its generation you lose capacity over time, you lose energy value over time, curtailment risk and cost goes up, as does the integration cost, meaning the cost of running other resources to support that renewables.

And we heard that from each of the utilities, that they do integrate these into their best fit methodology, but that it's a limited process. And this is something that they will then turn to the integrated resource planning process as saying this is one where we help to get better at doing -- getting better data about what these costs are, integrating them into our long-term thinking.

But as far as we've heard in terms of really 2030 kind of integrated valuation, it's still in nascent stages. It's not a very sophisticated art. And the utilities are not coming to us with we know this is what we need by 2030. I mean, nobody is. Nobody is saying, what's the optimum portfolio, but we are aware of what the factors are.

Next slide. I have a few -- I'm going to go

really quickly through these, actually. Go. Next.

This is -- I have three different views of utilities and different portfolios that they're imagining, just by 2020.

You'll see PG&E here. The middle circle, they've got solar at, I think it is, about 38 percent. And then by 2020 they expect to be at 47 percent solar. So that's one. And their other percentages are declining in terms of the percentages of different renewable technologies.

Next one.

Here you see SMUD. And really my point here is to show really dramatically different takes on portfolio. I don't have the reason behind them, but it does illustrate how different utilities are in very different places. SMUD's portfolio has quite a bit more biomass and biomethane. Its majority or plurality is wind, and a relatively small portion of solar.

Next one.

This is LADWP, their projection out to 2035. You'll see, starting the kind of darker green band towards the bottom is new wind. And then the purple above the -- so the orange is solar. Sorry. Starting from the bottom, the light green is existing wind, but then you see this dark green as new wind commitment. The orange is solar, which

they foresee, you know, a dramatic increase happening now. And then the purple is new geothermal. So they're making -- planning a substantial investment in new wind, new geothermal. And it's only that blue bit up at the top, which is kind of their unknown resources. Sometime in late 2020s we'll be seeking new resources.

Next slide.

Here are just, again, different snapshots of a few different utilities thinking about where those resources will come from. I mentioned LADWP because their mantra is location, location, location. They like to interconnect to their existing transmission system. But of interest, that existing transmission system extends through much of the west.

On the upper right there we see PG&E has recommended to RETI 2.0 that we help in their estimation of new resources by looking at those out-of-state renewables, and what does it mean to have the CAISO, an expansion of the existing ISO, or energy only.

And then lastly, San Diego Gas and Electric has repeatedly provided input, talking about Wyoming and New Mexico wind and the benefits that that can bring to complimenting their portfolio of resources.

Next slide.

So this map, a little hard to see at this scale,

I'm afraid. This combines two data sources which are pretty interesting for at least the near term. This is the REAT, Renewable Energy Action Team that the Energy Commission hosts but is made up of data from both federal and state permitting agencies about where new projects are being located. Those are the small circles, and you'll see their geographic distribution. And then you've got some larger circles drawn around the ISO Interconnection Queue Projects. And this is a data point that we're looking forward to using more.

Go to the next slide. Next slide please.

We've heard from multiple parties that the ISO Queue Cluster 9, which as of today the window for that cluster is closing, the request window. And we should have data within the next few weeks that will tell us about where current, as of today, commercial interest is in developing new projects. So we'll definitely use that and integrate that into looking at what the transmission need is within the focus areas and whether there should be an additional focus area. And then also I've got a few examples of places that were brought to us, including the north of Lugo, Salton Sea Area in Imperial Valley, and then the one in the middle there is the Westlands Water District for the San Joaquin Valley.

Next slide.

These are some of the conclusions from the California Wind Energy Association regarding the feasibility of additional development of new California instate wind. And the association was pointing out many of the potential barriers for new instate wind development. And you'll see circled there at the bottom one of those conclusions being that within the DRECP region, perhaps another 1,000 megawatts of additional wind development potential, and across California perhaps just 2,000 megawatts of additional wind capacity needed -- available. In the box you'll see some of those potential barriers. I think that in our process we can do some in the time that we have to investigate those, but probably not a whole lot. But we may be able to point to next steps in terms of understanding that.

MR. BERBERICH: Quick question about this, and Nancy, maybe this is a question for you. Of the 2,000 potential, how much of that is new and how much of that is repowered, or is it all new? Thank you.

MR. TURNER: You should probably come to the mike.

Can we save it for -- I've got like three slides.

MR. BERBERICH: Sure.

MR. TURNER: Then we can just do questions all at once, if that's all right.

Next slide.

Geothermal. Again, it's limited to a very few areas. Transmission is seen as one challenge among several. So if we can identify, what are the transmission options to access some of that geothermal, we're moving the ball. But there are many other challenges, economic and institutional.

Go ahead and hit next. Next.

This is talking about capacity value.

Next.

The flexibility of geothermal technology, we received some good comment on that.

Next.

The cost, the capital cost, for instance, our amount is telling us it's very different than what's included in the RPS calculator. That's some important information, as well as some of the other -- the PPA prices.

Next.

This what the Geothermal Energy Association tells us, again significantly lower than what's in the RPS calculator, and would have an impact on the commercial interest.

And next.

This was a study using the Low Carbon Grid Study framework, analyzing what kind of energy ancillary and capacity values might be have from developing 1,200 megawatts of geothermal in the Salton Sea Area, on the

overall California grid by 2030, kind of one way of getting at that portfolio value of individual components of a portfolio. So this is -- I thought this study was definitely interesting and a good contribution in the trying to pull out how does one technology contribute to the overall portfolio?

CHAIRMAN WEISENMILLER: But again, then people would have to actually bid that price and contract and deliver it, not just claim the numbers and, you know, put their money where their mouth is?

MR. TURNER: Yeah. Next slide please.

So out-of-state interest, I don't have a whole lot here, and that's potentially as a result of the effect that -- I believe this was the Southwest Power Group put in this cartoon. It's an old cartoon about, you know, the cop comes along and asks, "Where are you looking? What are you doing?"

"I'm looking for a quarter I dropped."

"Did you drop it here?"

He says, "No, I dropped it down the street."

"Why are you looking here?"

"This is where the light is."

And the point of the cartoon being that California resources keep looking at instate resources because this is what we know best, because we don't want to plan other

people's systems, we don't want to be sticking our nose in around the west, and yet it really may behoove California to make a very strong look at other states.

Go ahead and hit next.

That's what this comment is saying, and maybe one of the most important things we can do at this time.

Next.

And each of these is saying that California has not traditionally looked very well, very hard or very well at out-of-state resources and really should do so. So that is something that we'll continue to do, and I've got a proposal to do that.

Next slide.

And we know that there's a lot of projects going on. California utilities are signing with Arizona and Nevada solar with New Mexico wind. The wind projects in Wyoming and New Mexico are in advanced stages. And further outreach is necessary.

Next slide.

I probably hit upon all these. And in the interest of time I'm just going to leave them up and stop.

So do we want to finish that question that -- yeah.

MR. BERBERICH: Sure. My question was, how much of the 2,000 was new or repowered?

And, Nancy, while you're answering that, maybe you could talk about the repower potential, too?

MS. RADER: Sure. Thanks. Nancy Rader with the California Wind Energy Association.

That was sort of our membership putting together our collective best guestimate as to what we might, and I would say in our wildest dreams, perhaps see in new development in California, given the DRECP's effect on wind energy, which was not pretty. And that is not including repower. So we've got on the order of 1,000 megawatts of capacity that needs to be repowering, and it cannot be assumed that this is going to be repowered. These are generally small projects. They're really struggling right now in the current market. And we really can't assume that those are going to stick around in repowered fashion, I think, unless we do something about it.

Thanks for your interest.

CHAIRMAN WEISENMILLER: So, Steve, I had a question for you. You know, in the instate solar resources there's a list about substantial improvements in PV capabilities on the technical side, how many of these do we actually have at this point achievable, required either by the ISO or the PUC or the utilities?

MR. BERBERICH: That's probably for Neil to answer, but we do have some interconnection requirements

now. For the most part, I think the new solar installations are providing these things.

But, Neil, I'll let you expound on that.

MR. MILLAR: I'm sorry. I didn't quite hear part of the question. I apologize.

CHAIRMAN WEISENMILLER: Yeah. So basically, if you'll look at the instate solar resources, one of the things that Brian mentions is a substantial improvement in PV capabilities --

MR. MILLAR: Uh-huh.

CHAIRMAN WEISENMILLER: -- and things like voltage, VAR control.

MR. BERBERICH: And, Neil, invertor capabilities.

CHAIRMAN WEISENMILLER: Yeah, fault-wide through. And part of it is just how much of these are now in place and how much of those -- how do we achieve the rest of those capabilities?

MR. MILLAR: Well, generally those capabilities are available with the invertors. They're not being custom designed without. Many jurisdictions either require these resources or pay enough to reward that those are -- those have really become standard product designs for most inverters to have voltage control capability, the equivalent of inertia-type response --

CHAIRMAN WEISENMILLER: Right.

MR. MILLAR: -- to provide frequency control. So the inverters are generally package designed or bulk designed with those capabilities, and it's just a question of how we access them.

One of the problems with an inertia-type response from solar in particularly is that it only responds if there's still upside capability left. So it means idling as -- having a solar unit back off --

CHAIRMAN WEISENMILLER: Yeah.

MR. MILLAR: -- a little, just to provide the upside capability. So even though the units are capable of it, it's still not necessarily in the long run the most effective source.

But our understanding is that most of the new units now all have that capability as a standard product.

PRESIDENT PICKER: But that's a pretty recent event, and a lot of the earlier installations don't include it. And furthermore, because there's not a lot of product that solar companies can sell to, or they just have never thought of it since their real go is customer acquisition rather than integration and ongoing management, they just don't even enable those functions. They don't work with the customers. And so we're seeing our first couple test products coming forward.

MR. MILLAR: Yeah.

PRESIDENT PICKER: But while the potential is there, the reality is a ways away.

CHAIRMAN WEISENMILLER: Yeah. How about in terms of as the historical inverters die can we at least get them replaced with more capable ones going forward?

PRESIDENT PICKER: If we can get to code and energy efficiency --

CHAIRMAN WEISENMILLER: Right.

PRESIDENT PICKER: -- rather than just above code, I think we can do anything.

CHAIRMAN WEISENMILLER: So it's not easy.

MR. BERBERICH: But, Chair Weisenmiller, I think, though, you raised an important thing. As we get to higher and higher levels of renewables on the system, we have to use renewables to integrate renewables.

CHAIRMAN WEISENMILLER: Oh, yeah.

MR. BERBERICH: And, you know, the ability, for instance, to hold wind back to provide upward ramp, same thing with solar, getting DEC bids from them as they can move down, we're trying to do some of these things in our market. And we will continue to do them in our market, but we'll need more and more of that going forward.

CHAIRMAN WEISENMILLER: Yeah, you know, that's what struck me, is that we have the technical potential now and it's changing fast, but how do we, again, really get it

out on this system, at least going forward, and hopefully looking backwards to really move in those directions?

MR. BERBERICH: Yeah. I think we have a bit of good news. We have on -- the last several months we routinely curtail 1,000 to 1,500 megawatts every day at peak, thousands of megawatt hours. But almost all their curtailments have been handled by economics. So people have given us DEC bids and we've been able to leverage those without having to actually do command and control curtailments. We have had to do some of those.

The other thing I would note is that the Energy Imbalance Market has been an amazing relief valve for that. And any given day we're sending thousands of megawatt hours out of state, as well, that would have otherwise been curtailed.

CHAIRMAN WEISENMILLER: Okay. And I had a question for Scott. In terms of looking at some of the areas that Brian had looked at for going forward, part of it is just what does the Pacific Flyway mean? You know, part of it is trying to -- you know, I think that Karen and I heard a lot, this is a cry to be smart from the start. And so particularly looking at the Northern California wind, how many avian -- you know, we're going to hear Nancy two years from now talking about how this process shut them down in some fashion after we sort of launched in that direction.

MR. FLINT: Yeah. As I was saying earlier, Chair Weisenmiller, the information we have on avian movement is not as easily mappable. But we do know that area is high concentration water fowl area movement. They move -- they use both the rice lands around there and the wildlife refuges that are there. They move back and forth between the rice lands and refuges in that for water fowl. It may be less of an issue for other species, but there we know we're going to have some concern. And we want to be able to assemble enough information to be able to speak objectively about that concern. So that was -- that's our goal for that area. But we do know right now, and folks have brought up, stakeholders have brought up several times in their comments that that area is likely to be a problem are for potential bird impacts.

COMMISSIONER DOUGLAS: Scott, just a quick follow-up question. You know, I understand that the Pacific Flyway issues and the potential bird impacts would need to be looked at very closely. But I also understand that that area has a relatively lower number of threatened and endangered species issues in general compared to San Joaquin or the desert. Can you speak to that a bit?

MR. FLINT: I think generally, yes, but we will be able to evaluate that also. I don't know that area as well as the deserts, because I had my head buried in the desert

for the last eight or nine years. Well, when I worked in San Joaquin I had to figure out where I was on the map the first time.

So anyway, I think we need to look at that. It could be so, but it also could be a high degree of rarity and just less development pressure. So I think we need to objectively evaluate that.

COMMISSIONER DOUGLAS: Yeah, I think that's a good point. I know some of the environmental groups I see in the room have done some work up north. And maybe in public comment they can speak to that question, as well.

MR. FLINT: Just to let you know, this was a topic of conversation at our meeting this month with the Environmental and Lane Use Technical Group. And we got lots of good information from folks about some other data, too, that we don't have to actually dig into for that area.

CHAIRMAN WEISENMILLER: I just want to make two general comments from sort of dealing with the banks for a number of years.

One is the banks, when you get to new biomass projects, they always start off with a speech about how, well, they're not like the California projects, you know, that in the '80s a lot of the projects basically were built, and then the Spotted Owl, they were dead fairly quickly in terms of supply. So there's an awful lot of skepticism on

the banks on financing biomass projects in California.

And the other one is with the problem with the Low Carbon Study, any number of these things, there was also a time when everyone believed if you built the most efficient plant in the west you would make money, tons of it. All those entities went into bankruptcy at some point when they discovered with not having contracts, or at least the whole system of the contracts meant you could have a very efficient project that just sat there and ultimately died.

So the models do the best they can to represent the realities of the system. But that whole contractual permit and everything overlaid means one can take them too seriously.

Okay. Thanks. Let's go. Good job.

MR. TURNER: Yeah, let's move forward. I have to apologize, I let us slip behind schedule a bit there with my last rambling on, so my apologies. And I'm going to be pretty quick on this next one.

Next slide. Next slide after that.

This is really the approach that we took. It's my mighty questions because it's four mights in a row. It's just illustrating that this is a high level kind of process.

Next slide.

So this is really the money slide. This is where we're going to be working for the next couple of months.

And it goes in order of specificity, starting with the instate resources, looking at the import-export paths, and then out-of-state projects. And I'll go into some more detail here.

Next slide. So California -- next slide please.

California Desert. This is following our advice to build off of what we've got. This is building off of the Desert Renewable Energy Conservation Plan, though I have to stress that this is not part of the DRECP. This is not a new phase or anything like that but we will utilize the information, though we'll be utilizing the information back from September 2014 where there was development focus areas that included both private and public information. Again, we're not making any assumptions about what's permittable in that area, but we are taking those areas that had substantial work to get down to those development focus areas and saying what if you developed a certain amount of resources in each, also building off the transmission work that was done in the Draft DRECP.

There was an infrastructure-focused tinker toy conceptual transmission plan done for that process. But from the stakeholders, I understand that there is more work that would be beneficial to do, understanding how you would be connecting the generation to load.

Next slide.

I'm going to go -- I'll talk about what's here in the numbers, and then I'll skip through the other ones in the interest of time.

Really, the reason that there's a whole series of numbers here -- so this is the Tehachapi development focus areas, Tehachapi CREZ in the RPS nomenclature. This is around the towns of Tehachapi and Lancaster. The reason for all these numbers as our data points in terms of how much resources, additional resources might come from there, you've got the RPS calculator has technical potential figures, really, again, eye-popping on the solar, but it's that way throughout the state really.

You have some commercial interest data from the CAISO queue and the CEC database, so these are existing proposals of one form or another to develop in this region. You have the Draft DRECP assumptions used there in terms of what the resource potential is. RPS calculator numbers here are used to illustrate how much might be economically beneficial under different scenarios, and I want to make them relative.

So if you had an in-state California-focused portfolio, you would be looking to acquire a certain amount. And the 1,700 is not necessarily the right number here. It's relative to the other ones. If, however, if you were to restrict the environmental preferences on other regions

of the state and direct procurement towards DRECP areas, then you would be procuring more from this area. So environmentally preferred yields more selection in this area.

But if you were to open up procurement west-wide, this area become less competitive than it is under a California scenario, but not much. Which, to me, indicates that, actually, this is a good resource area from an economic potential and remains so under a variety of assumptions.

You have the existing energy-only transmission capacity. This comes out of the study that Neil described, meaning how much -- so we'll be able to provide more insight into the robustness of that number, as well as what would it take to go beyond it? So we've put a proposed study range. I'll ask the Transmission Technical Group and the Environmental and Land Use Group to study, what would it mean to develop and interconnect for 4,500 megawatts of solar from this area and 500 of wind? And the reason that we have a study range here is you need a specific number to hand to the transmission planners so say, what would it mean to interconnect to this? So it's not really meant to indicate development, specific development or procurement numbers, but just as an indicator to then illustrate the transmission implications and environmental land use

implications.

Next slide.

Victorville. Barstow.

Next slide.

Riverside east.

Next slide.

Imperial Valley. So these are four areas building off of the existing DRECP work where there appears to be substantial resource potential, substantial commercial interest. Models pick those areas as being good ones to go to for resources, so let's study a specific resource range from each. I proposed a resource range based on these data and other stakeholder comment. Really, there's no magic formula to it. It's pretty eyeball.

Next slide.

So then the second major grouping of areas within the state is the San Joaquin Valley from Modesto south to Bakersfield. This, again, building off of existing work, one of the recommendations that we got. This does build off the San Joaquin Solar Initiative that identified over 450,000 acres that by a consensus or a process to work towards near consensus among agricultural, environmental, local land use, tribal and other interests, could identify areas that would have less conflict but certainly more could be done about what the implications are for interconnecting

a certain amount of generation from this area.

And I want to stress that while the San Joaquin Solar received a lot of input, a lot of support, there is commercial interest outside the lease-conflict's lands that they identified. We'll also look at those. The new interconnection queue data that I discussed previously will help us do that.

Next slide.

Here you see several data points from the CEC and CAISO interconnection queue, the San Joaquin Solar Study. And the lease-conflict's lands is kind of the dark green blob in the middle -- actually, it's a bright green blob.

I'll also point out, this has substantial overlap with California backbone issues, that is the Path 15 and 26, taking power from the north of California up to -- from the south up to the north, or vice versa. And so by studying this area we may be able to get at some of the issues that arise with north-south trade in California.

Next slide.

Northern California is our last major area within the state. And this includes around the Bay Area, the Solano CREZ, the Sacramento River Valley. And then northeast California has a lot of solar potential but, importantly, why it comes up in such priorities is its wind potential keeps getting selected in the RPS calculator as

having some of the best remaining wind resources within the state. But there's a lot of skepticism about that, about at the environmental information, and also the transmission information, very sparse. We don't really know what the potential is up there.

So what we hope to do is provide more information. We'll gather the best that we've got, give us some more indication of whether this really is a feasible resource that deserves some next steps, or whether it's not worth following further. And this has overlap with California Intertie -- California-Oregon Intertie issues.

Next slide.

Oh, there's a picture of it with some of the data there that I mentioned. It's worth studying at another point.

Next slide.

So now talking about regional issues, and we've got two proposals about how to tackle regional issues. The first focuses on the import-export paths, the point of delivery to the California ISO or other California market. That is whether you're talking about TransWest of Zephyr or Gateway or SWIP North, these other regional projects, the south line -- the Southwest Power Lines, they deliver to El Dorado Valley or to Palo Verde Hub, and then it's got to get to California load. So it makes a lot of sense -- oh, and

you've got existing transmission lines that may be repurposed or new resources coming in, contracts expiring, et cetera.

So it makes a lot of sense to look at what's our potential for increasing the amount of renewables coming from those specific points of delivery. So that's one. And also those would be the path by which we would export resources, as well. So it makes a lot of sense to take a scenario that looks at what does an increase of renewables through those points of delivery look like, either from a delivery project right to that point or network projects that increase your access to a variety of resources coming to that market hug.

Next slide.

These are the example points and the ranges that we propose to study. Really, it's the El Dorado-Mead marketplace complex of delivery points, Palo Verde or Delaney, the California-Oregon Intertie which also is actually three different lines.

And then Central Sierra. And this is more speculative, but it is something that gets raised in a number of studies that Northern Nevada resources or Southeast Oregon would like to come in to California by Path 76, the Path 24, the Silver Peak Control, Dixie-Oxbow Line which is kind of Central Sierra, these places, most of them

are relatively small, weak systems and would be stressed by even a small amount of new power. So does it make sense, is there enough resource on the other side? Would it make sense to do any kind of upgrade there? We don't have a whole lot of information. So this will be fairly speculative, but seemed worth taking a look.

Last -- next slide.

Last category of discussion we'll undertake is evaluating out-of-state projects to the best that we can. As California entities that's very difficult to do, to go out and say, oh, what does the Gateway Projects mean for PacifiCorp, and what does that mean for how California could access resources? SWIP, it's wholly within Nevada. It does not connect with the California system, so what does that mean for our ability to access different resources? But it does. It has substantial impact.

So what we propose doing is not asking, you know, the ISO and Modesto Irrigation District or IID or others to do a technical evaluation, but rather to ask our regional partners to give us their best information. I think how I'd like to do this is ask a third party to host some workshops, perhaps out of state even, to solicit that information that is not so California-dominated, frankly, and get that information in their context. So that's the third category of evaluation.

Next slide.

Our next steps, I think I've described some of this. We'll -- so for the next two months we'll be evaluating these focus areas. So by the end of June, early July, we'll have some preliminary results for you all. What the Plenary Group will be doing during that period is refining these focus areas, including the ones that I propose, whether there's other ones that make sense. We'll be doing some outreach to specific constituencies that we haven't touched as much as I'd like, local communities, military, tribes, to get their input. And then working on this out-of-state workshop idea.

And last two slides. Why don't I turn it over to Scott? He'll talk about next steps a bit.

MR. FLINT: Yeah. So our big picture, next steps, going back to the charge of the Environmental and Land Use Group, is to finish collecting the data, make it available, review it, publicly accessible, finalize our Environmental Profile Report look and feel and content, and then talk about how to best summarize that to compare areas, and then working iteratively with the Plenary Group and the rest, the Transmission Group, to utilize our information to then look at the environmental land use implications of these focus areas. And then we will have reports to the Plenary Group in late June. And we'll participate with the Plenary Group

in writing the final report.

MR. MILLAR: Thanks, Brian.

Yeah. So the next step for the transmission group is to start taking a look at the kind of scenarios that the Plenary Group has developed and start to provide the assessments as best we can of the implications of accessing some of those volumes.

The schedule never did really allow for a separate round of study. So we will always -- we will be making those assessments based on what we already know of the system. And where we've studies higher levels in the past, primarily that's looking at generation interconnection studies, where in our cluster study approach occasionally we've studied some very high volumes in certain areas, so it's one source of information.

Some of our exploratory transmission planning studies will also help, as well as the work we've already done on the studying 50 percent renewables scenarios that were done last year on an energy only basis. So really relying on the work we've already done to provide some subjective opinion of the implications is our next step. And then identifying out of that where we can the sort of conceptual alternatives that could help achieve some of those resources.

And I would stress, it's alternatives. There's no

intention to try to pick winners or losers of transmission projects, certainly at this stage. It's really to get an idea of the kind of implications we're looking at.

MR. TURNER: Great. And that's it from us.

CHAIRMAN WEISENMILLER: Thanks a lot. I think my sort of wrap-up in a way is, first of all, it's pretty clear that we have a rich variety of renewable resources, that there's no reason that we have to develop every single kilowatt hour to get to where we need to get. And, in fact, I suspect by the time we look, you know, that all your estimates have to be scaled, you know, whether it's half or a third or something. Because the only way you get to the really high levels of renewables is if our energy efficiency programs fail. And frankly, we're not going to allow them to fail. And they're certainly at the top of the loading order.

So I think that's sort of number one, is we can certainly, going forward, look at diverse portfolios that really have, you know, the best environmental footprint, best economic footprint, you know, just sort of going forward, and try to fill out some things of what our future looks like going forward. But again, I don't think we have to get every single project online, but some scale.

I think it will be good as we think, also, on some of the options, certainly the military has very ambitious

plans at China Lake and Twentynine Palms which are stranded because of transmission. So that, you know, any potential transmission from Nevada that goes through that area and connects past the bases could really open up a lot of what the Department of Defense wants to do in California.

I think we're struggling. You mentioned NREL's study on geothermal. Well, actually, there's a couple. I don't know if someone needs to get a refund on his study of not. But there's a more optimistic and a more pessimistic one. And so, again, part of my message for folks on geothermal is I like to see this stuff happen but, you know, looking for people to really start winning bids and not just talking about how good their prices are. You know, and so as we go forward, you know, that's something we have to again factor in.

But again, the basic message, I think from all the studies is certainly a diverse portfolio is going to be better than if we just say that we're going to go all solar or all wind or all geothermal. I don't think anyone has a good sense yet of what the mix is. And, in fact, some of it we're only going to find out by going out to bid and see what really comes in going forward.

PRESIDENT PICKER: I just want to say that you guys have done an enormous amount of work. I want to thank you and your teams. And I really appreciate the progress

that we've been making. It's still fairly conceptual, it's still fairly high level, but that was the intent all along is to begin the discussion to come up with some potential new pathways or expansion of existing corridors, and then let the regulatory process start to kick in. So I'm really pleased at what you've been able to achieve, and I'll be looking forward to more.

I also have to say, I have to get on a phone call at 4:00, so I hope not to miss all the public comment.

MR. PEREZ: I do just want to acknowledge all the great work that you've done focusing, also, on the interagency component with DRECP. We've kind of worked through that as an agency, trying to set priorities and trying to filter down to where we want to work. So I appreciate that work that you've kind of engaged us along the way also.

MR. BERBERICH: It's a great piece of work. You guys have come a long way since the last time we all gathered, and we appreciate that.

I know that you're sort of solving a multi-regression equation for all kinds of different variables. Let me just add one. California has a very high cost transmission system. And I want to make sure we keep our eye on finding the minimum necessary transmission to solve for this.

COMMISSIONER DOUGLAS: I just briefly wanted to say it's very clear that a lot of work has been done, and so I'm impressed. I really wanted to come to this to see what work had been done, and I'm really happy to hear. It was a very substantive set of presentations today.

I also have a four o'clock call that I need to get on. I'll try to stay -- I'll try to be a little late to the call, but I can't be too late. So anyway, thank you.

CHAIRMAN WEISENMILLER: Okay. So let's start with public comment.

First, Duke American.

MR. BIERING: Good afternoon. My name is Brian Biering. I'm here on behalf of Duke American Transmission. DATC is an existing participating transmission owner. We own majority interest in the Path 15 Upgrade Project, and we're also a transmission developer, as well.

I'm here to express our support for RETI 2.0, and in particular the achievement of the state's 2030 climate targets. We see RETI 2.0 as playing an integral role in achieving the 2030 GHG targets and moving beyond some of the existing limitations, for example, it the transmission planning process and the ten-year time frame and that process. We think that for the state to really achieve the 2030 targets we need to start planning now. We need to have a flexible transmission planning process that, you know,

really accounts for the inherent uncertainty in the various generation scenarios that were outlined today.

We see there is a major issue with the potential for the cost of failure to hedge for this uncertainty. So as part of creating a flexible transmission planning process we really need to look at the vast variety of the generation scenarios, and also consider the potential for full capacity deliverability scenarios, and not just look at energy-only scenarios. We think that in doing so the state will be in the best position to really provide early signals to renewable resource developers to achieve a diverse set of renewable scenarios and a diverse renewable portfolio that we'll need to meet the 2030 targets and move beyond the 50 percent RPS. Thank you.

CHAIRMAN WEISENMILLER: Thank you. TransWest?

MR. SMITH: Hello. Thank you. My name is Dave Smith, representing both TransWest and the Power Company of Wyoming.

I, too, think that this group has done a tremendous amount of work over the past six months identifying different data sets and bringing forward the information that was brought today. I did want to just point out a few things that are kind of in response to some of the dialogue today.

One was I think Commissioner Peterman and

President Picker asked about regulatory-grade data. And I think there's a lot of regulatory-grade permitting data out there, especially for the out-of-state resources. Both Power Company of Wyoming and TransWest are in advanced permitting on a regulatory grade set of information. SWIP North has received that, as well, as well as the Gateway Projects.

So I think that as this group is looking at environmental data that you also have to consider that there's regulatory permitting data that is out there that's very useful to use and can kind of limit how much of the data sets and everything else that have to be looked at for some of these out-of-state resources.

The other thing I wanted to mention was about transmission capacity, and back to Mr. Berberich's point about using the transmission that we have and not building more transmission. The results that we've seen is that a fair amount of the system has been built out in California, and a lot of energy-only resources could be accommodated without extra transmission. I don't think that's the case for out-of-state. Transmission is going to be needed if you need to access or want to access the benefits of out-of-state resources. So I think that spending time on that would be very useful for the RETI group. I understand Brian is recommending another set of third-party discussions for

that, run by a third party.

I think that all the interregional planning groups are already working on study plans and have that information. That's a great place to start for all that information.

My last point is while a lot of information has been put together, you know, there's also some form of a timing concern on putting a list together. It takes a long time to build transmission projects. It takes a long time to build these types of resources. Currently today you're 8 years away from a 40 percent RPS target with SB 350. I understand the planning is going to go on for another couple years before you approve any projects, and I think you have to kind of keep an eye on that. There's two -- or one major reason why that might be beneficial to keeping an eye on the 40 percent RPS in some of the nearer term things.

The federal government has extended the tax credits recently on different projects. That could be of substantial benefit to California if they could secure resources that have -- secure those kind of tax credits. That's going to wind down in a bit, the tax credits. And the sooner you move on that the quicker those benefits could be applied to Californians. Thank you.

CHAIRMAN WEISENMILLER: Thank you. Nancy Rader.

MS. RADER: Thanks. Nancy Rader again with the

California Wind Energy Association.

First, I just wanted to note that on the Northern California wind potential, in general those resources are only going to be built if we cannot access out-of-state wind resources, because there's just inferior wind quality. We have a shot at repowering the existing stuff because those are in some of California's best areas. In general, the Northern California wind quality is pretty poor compared to out-of-state resources.

And then secondly, I just wanted to highlight that we really have no need for transmission right now. As Mr. Millar indicated, the CAISO study shows that we have plenty of transmission instate for energy-only resources, and even some for full deliverability resources. And then Mr. Berberich stated there's really no physical constraint to exporting any excess. The issue there really is the ability and desire of the out-of-state balancing areas to accept that power and to be willing to back down their own power plants, so we don't need any transmission there either.

And then as to Mr. Millar's quote "critical question" of do we want capacity value from renewables, well, that's really why we started to look at energy-only in the first place because at high penetration levels wind, and particularly solar, have very little capacity value. And so it doesn't make a whole lot of sense to upgrade the system

to capture that value.

And then I really want to highlight something that's been overlooked in this process to date, and I hope that the next workshop we're able to look at it, which is that we really have quite a bit of capacity in the west freed up from announced coal plant retirements. In fact, the WECC study that we highlighted in our comments last week show that over 5,000 megawatts of wind and solar could be imported by 2030 with no new transmission at all, and up to 15,000 megawatts could be imported with very modest transmission upgrades.

So I think the good news is that we have quite a bit of breathing room before we really have to, you know, try to do look into a crystal ball and plan, at least for purposes of transmission development. There's quite a bit of capacity out there and I think we need to look hard at that. Thank you.

CHAIRMAN WEISENMILLER: Thank you. Smart Wires?

MS. STEICHEN: Hi. Renae Steichen from Smart Wires. And I just had two points.

One is to, in the instate and out-of-state studies, as we move forward and look at transmission implications of these resources that we consider lower voltage, in addition to high voltage issues, because we often see that that's where some of the constraints happen

in the system is on the lower voltage lines.

And then also looking at making sure that transmission utilization improvements are considered in addition to traditional upgrades such as new line and re-conductors since those can often be much lower cost and lower environmental impact, and be implemented faster than traditional solutions. Thank you.

CHAIRMAN WEISENMILLER: Thank you. Thank you Nature Conservancy, Erica?

MS. BRAND: Hey, everyone. Erica Brand, the California Energy Program Director for the Nature Conservancy.

So I want to first start off with saying I strongly agree with Chair Weisenmiller about the importance of the loading order and preferred resources. I know that RETI 2.0 has focused on large scale because we're thinking about transmission, but those are a really important piece of achieving our broader clean energy goals.

We appreciate that RETI 2.0 has made environment and environmental impacts a principle for planning for our clean energy future. The study that Brian noted earlier found it possible to achieve a 50 percent portfolio with a low impact to ecologically important lands. And continuing to make progress on achieving our renewable energy goals in a way that minimize environmental impacts is important,

especially when we think about California's broader climate goals and avoided conversion of natural and working lands.

For RETI 2.0, as mentioned earlier, we think it's important to build upon the places where we've already invested in studying for renewable energy and conservation, where we know that we have bottlenecks right now to catalyzing low impact renewable energy development, so San Joaquin Valley, places within the California Deserts, like Imperial County, and the DRECP planning area. Further study of these geographies is a smart investment of resources and time, especially given the pretty narrow window that we have for the RETI planning process.

And I think an important piece of that is really prioritizing the transmission assessment focal areas that are considered in RETI. I think Nancy raised some really good points about commercial interest of resources, especially in Northern California.

And since Karen brought it up earlier I'll just briefly mention, I'm not a Sacramento River Valley expert for my organization, but I agree with Scott, I think it's going to be real important if that transmission assessment focal area continues through the process that we really make sure that we're bringing in the right data about ecological, avian migratory pathways, and also agricultural values. So thank you.

CHAIRMAN WEISENMILLER: Yeah. I was going to note that one of the things which I'm hoping is that, and I'm assuming it's been set, that two weeks from now we'll ask people to provide written comments on their thoughts from today's sessions, again to give everyone a little more time to think about implications.

MS. BRAND: Okay. Great.

CHAIRMAN WEISENMILLER: That would be great.

MS. BRAND: Thank you.

CHAIRMAN WEISENMILLER: All right. Kate Kelly?

MS. KELLY: Good afternoon. Kate Kelly with Defenders of Wildlife. And thank you for today and all the hard work that's gone into this process.

We reiterate the comments that Erica Brand just so ably made as part of TNC, but that you'll find that they also are captured in comment letters that you'll be receiving.

To focus on the issue of the transmission assessment focal areas, it really is important, in our eyes, to make use and leverage the amount of time and effort that have already gone into some of these areas that have been studied, leverage the public investment, as well as the private investment in those areas, and the science that's been done. And so to that end, of course, the desert, Imperial and San Joaquin Valley would be what we would

prioritize.

In thinking about the other areas in the Northern California idea, yes, good data is going to be very, very important. What our organization knows about that area is there are a lot of very sensitive resources. It is home, you know, besides the Pacific Flyway which is well known, the number of species that run up, both through the valley and then further on up into what you can call, you know, the Modoc Plateau, Golden Eagles, Sandhill Crane, red-legged frogs, pond turtles, those sorts of things, there's a variety of critters out there that are threatened and endangered. So it's going to be a challenge to look at those areas.

Additionally, the valley right now in California represents of one of the largest active agricultural areas that has water and is likely to continue to have water. So that adds an additional level of complexity when thinking of moving further to the north.

Thank you again for today, and I we look forward to submitting our comments.

CHAIRMAN WEISENMILLER: That's great. And certainly if in your comments you think a little bit about the areas around California, if there are any areas where, again, are either particularly good or particularly bad from an environmental perspective.

MS. KELLY: Yeah. We will definitely --

CHAIRMAN WEISENMILLER: It would be good to hear both of your perspectives on that.

MS. KELLY: We will definitely be bringing that forward. One of the areas that we think was an area of particularly interest, both looking at California, but then as we move outside of California, is how to pick up, and I say this as a land use planner, how to pick up the issues of private lands, and then how those lands are regulated and how that would fit into renewable energy development. So thank you.

CHAIRMAN WEISENMILLER: Thank you. Nathan, PG&E.

MR. BENGTSSON: Good afternoon.

First of all, I just want to say that we have made an enormous amount of progress. And I also want to say that the structure of this process is really well considered. The proposal of the TAFAs and then their evaluation by the various technical groups is the right way to do it. And I want to thank Scott, too, for keeping us on track on the ELUTG, so I appreciate that.

One thing that we were delighted to see at the initial proposal of the TAFAs was the alignment of the TAFAs with the CREZ areas. It doesn't seem to me like that's still exactly the case. And I think we'd love any insight you have about how you see them in their current form

playing nicely with the existing planning processes that will eventually get new renewables built. As we've said many times, we want this process to inform the existing planning processes, and we hope that the TAFAs will help do that.

That's all I have of now. Thank you.

CHAIRMAN WEISENMILLER: Thank you. Let's go to NRDC. Julia, please.

MS. PROCHNIK: Hello. It's great to see so many familiar faces.

CHAIRMAN WEISENMILLER: Right.

MS. PROCHNIK: Thank you guys very much for all the work you're doing. I'm Julia Prochnik from Natural Resources Defense Council. I just wanted to mimic my colleagues Carl Zichella and Helen O'Shea, that we really appreciate this process. So much work is being done and we look forward to the next steps and to work together with everybody.

I also wanted to support Erica's comments about looking at zones and really kind of focus a lot of the aspects there. And then highlight -- it's so great to hear the change of tone in looking at the regional perspective. I think that that's a really good aspect for the State of California and for all of our neighbors. And so continuing to work there and continuing that outreach I think is

critical.

And along those same lines, the work that Neil is doing, and I'm sorry that he stepped out of the room, but with his group on the scenarios, I think it's really important that the scenarios that he creates with his colleagues is shared with the regional planning organizations that he highlighted in that presentation. Those groups really need to work together. They're tasked to coordinate. And I think they're missing some of that key data that this group can provide. So if that can get shared, that would be great.

And then the last point is just to say thank you again to everyone's hard work on this.

CHAIRMAN WEISENMILLER: Well, I was going to say thanks again to Carl for his hard work on the regional issues. We appreciate that over the years.

I think at this point we're at WebEx. Rachel Gold?

MS. GOLD: Hello?

CHAIRMAN WEISENMILLER: Hello. Please go ahead.

MS. GOLD: I'm calling in today. Sorry I couldn't be there with all of you in person. Thanks for a really protein-rich afternoon and providing a lot of additional information, especially on the proposed focus areas. That was really appreciated.

I just wanted to make a brief comment and say that we have been following this effort really closely. And I think that a lot of the work around looking at current development interests and where that aligns within current CREZs. And the transmission work has been helpful to move the needle further.

One area where we think that it could be a little more clarity about what we're doing and how that's going to play into the outcomes of the renewable(indiscernible) is the work of the Environmental and Land Use Working Group. A lot of that information (indiscernible) into that data very closely. And there's some questions, at least on our end, and I think others may share them, about what exactly questions we're working on (indiscernible). So to the extent that that can be part of the going forward effort, if we would really appreciate it.

Thanks for enabling me to participate virtually today.

CHAIRMAN WEISENMILLER: Okay. Thank you.

Steve Uhler please, also WebEx.

MR. UHLER: Hello. Hello. Am I on?

CHAIRMAN WEISENMILLER: Yes, you are. Please go ahead.

MR. UHLER: This is Steve Uhler, that's U-H-L-E-R. I'm calling you from the county and the State of California

that's had the largest increase of greenhouse gas from electricity, that would be Sacramento County. I know this from your QFER database, although I'm a little concerned about the quality of that database because there's a lot of easily identifiable errors, like cities that are not in certain counties and such like that. So I would hope that you guys could clean up that and make that regulatory grade.

My concern is whether or not you're going to drop enough lines in here so we can actually get some renewables in Sacramento County. I'm sitting here with enough storage that I can control at will to demand, and actually add power back to the grid at five times what my solar capacity is. And I'd like to know, you know, what kind of pathway is going to be cut for people who are using storage at their homes so that we don't have to pump all this power through all these wires. I'd really like to know where to get good solid data, like at least a list of all of the equipment. There's only about 1,500 power plants in the QFER, yet they can't seem to tell me exactly where they all sit. I kind of wonder about the data set.

So once again, I'm looking to the situation to solving this problem by local storage. My lights never go out. It would create quite an opportunity. We've got a guy up the hill in the desert who's going to make lithium batteries. I'm waiting for his stuff to come online so I

can actually power some more equipment than what I'm doing right now. But instead of hanging a bunch of wires, I would also like you to consider a situation of storage, as you say, behind the meter, like in my situation, to enable that.

The big thing is, is I'm really concerned about the data sets. When I hear somebody's using a spreadsheet to do models instead of a modern relational database, and if you are using a modern relational database to do the QFER, somebody doesn't understand normalization. You've got data in there that is obviously incorrect.

So I thank you for this time, and keep up the good works. I'd like to get somebody from the Energy Commission to contact me about the data issues that I see and how I see to correct them. Thank you.

CHAIRMAN WEISENMILLER: Okay. You should reach out to our Public Adviser and work on it that way.

I think that's all the public comment, so this meeting is adjourned. Thanks.

(Whereupon the Joint Agency Workshop on the Proposed Renewable Energy Transmission Initiative (RETI) 2.0 adjourned at 4:14 p.m.)

REPORTER'S CERTIFICATE

I do hereby certify that the testimony in the foregoing hearing was taken at the time and place therein stated; that the testimony of said witnesses were reported by me, a certified electronic court reporter and a disinterested person, and was under my supervision thereafter transcribed into typewriting.

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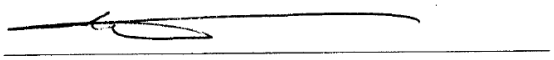

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IN WITNESS WHEREOF, I have hereunto set my hand this 13th day of May, 2016.

MARTHA L. NELSON