BEFORE THE
CALIFORNIA ENERGY COMMISSION

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	)	Docket No. 11-IEP-1N
	)	
Preparation of the 2011 Integrated Energy Policy Report	)	

IEPR Committee Workshop
Smart Grid Research Road Mapping Projects

CALIFORNIA ENERGY COMMISSION
HEARING ROOM A
1516 NINTH STREET
SACRAMENTO, CALIFORNIA

FRIDAY, DECEMBER 17, 2010
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Reported by:
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COMMISSIONERS

Karen Douglas, Chair
Robert Weisenmiller

STAFF

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Mike Gravely

ALSO PRESENT

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Kevin Passo
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P R O C E E D I N G S

DECEMBER 17, 2010 10:08 A.M.

MS. KOROSEC: All right, we're going to go ahead and get started here. Good morning, I'm Suzanne Korosec. I manage the Energy Commission's Integrated Energy Policy Report Unit. And welcome to today's Workshop on Smart Grid. This workshop is being conducted jointly by the Energy Commission's Integrated Energy Policy Report Committee and the PUC. Unfortunately, Commissioner Ryan from the PUC had a last minute conflict and is unable to join us, but we will be certain that her office receives a summary of the workshop, along with the transcript of today's discussions.

This is the second in a series of workshops looking at the technologies that are available to further California's Energy Policy Goals and to reduce the impacts on the California Grid of meeting those goals. On November 16th, we looked at energy storage and automated demand response, and today we're looking at technologies that will make the future smart grid work. These workshops are informed by the Public Interest Energy Research, or PIER Program, which assists the IEPR process by providing the latest information on what technologies will influence future policy. Today's workshop will help us understand how the different key players, the investor-owned utilities, the

publicly-owned utilities, and the industry see the Smart Grid of the future and what technologies will have the most promise in helping California succeed.

Before we get started, I want to cover some housekeeping items, give some brief context for how the topic of Smart Grid has been covered in past IEPRs, and provide a quick overview of today's agenda. For those of you who may not have been here before, the restrooms are out in the atrium through the double doors and to your left. We do have a snack room on the second floor at the top of the atrium stairs under the white awning, and if there's an emergency and we need to evacuate the building, please follow the staff out of the building into the park that is diagonal to the building, and wait there until we're told that it's safe to return. And remember to bring your umbrellas.

Today's workshop is being broadcast through our WebEx conferencing system and parties need to be aware that we are recording the workshop. We will make an audio recording available on our website within a couple of days, and we'll make the written transcript available on the website in about two weeks.

The Smart Grid and the IEPR – the 2009 IEPR discussed the crucial role of the Smart Grid in California's future electricity system, particularly as the state

implements energy policy goals for increased energy efficiency and demand response, increased renewable resources to generate electricity, and also increased use of electric vehicles to displace petroleum use.

Smart Grid Technologies will also increase the reliability of the electric grid by allowing grid operators to better monitor grid performance and address problems more quickly, which reduces the number of failures and faults, and increases the efficiency and cost-effectiveness of the Grid. Smart Grid will also provide new methods and technologies to implement energy efficiency and demand response through increased two-way communication, smarter consumers, and products and tools that allow consumers to make smarter energy decisions.

Smart Grid will also help integrate renewable resources into the Grid through management of energy storage, distributed generation, automated demand response, and distribution level renewables, allowing the Grid to accept much higher levels of renewable resources while maintaining reliability. Smart Grid is also going to allow the integration of high numbers of electric vehicles and plug-in hybrids, without causing major disruptions on the Grid, and could even allow those vehicles to be used as Grid assets that could provide ancillary services when parked.

In the 2010 IEPR Update, the draft of which was

released earlier this week, we discussed cost share funding from the PIER Program that was used to leverage millions of dollars in Federal Stimulus funds for Smart Grid research. PIER has awarded more than $13 million to 17 Smart Grid projects, leveraging more than $400 million in Federal Stimulus funds, along with more than $800 million in private investments. This amount of funding for Smart Grid research represents a ten-fold increase over what's been done in the past. And this influx of additional funding is really going to accelerate the rate of industry growth and allow the PIER Program to make a quantum leap in achieving its research goals in support of our energy and environmental policy goals. This funding is also going to help California achieve the goals in the Governor-Elect's Energy Plan for adding 12,000 megawatts of distributed generation and 8,000 megawatts of large scale renewables, as well as using energy storage to address peak power demand and to firm up intermittent renewable resources.

For the 2011 IEPR, the IEPR Committee released a scope earlier this year, noting the need to examine energy storage issues, renewable integration, and electricity infrastructure planning, and Smart Grid is clearly a key component of each of those areas. So, for today's agenda, I will hear first from Heather Sanders, from the California Independent System Operator, about the CAISO's Smart Grid

Objectives and Strategies; next, Mike Gravely from the Energy Commission's PIER Program will provide an overview and history of the Smart Grid Research Road Mapping projects that are being funded by PIER; that will be followed by presentations on the three projects by EPRI, JPL, and RW Beck. We will hear about the Smart Grid and the Investor-Owned Utilities this morning, we'll break for an hour for lunch, and then we'll resume in the afternoon to the presentations on the Road Mapping Projects for Vendors and Manufacturing, and then for the Publicly-Owned Utilities. And there will be an opportunity for Q&A after each presentation.

Later this afternoon, we'll hear from the PUC on the status of its implementation of Senate Bill 17, which requires the Investor-Owned Utilities to develop and file Smart Grid Deployment Plans with the PUC by July 1 of 2011. We'll then open it up to public comments, after which Mr. Gravely will talk a bit about Action Items and Next Steps. During the public comments section of the agenda, we'll take comments first from those of you here in the room, and then we'll turn to the people who are participating on WebEx. For those of you who are here in the room, it's helpful if you can speak at the center podium and use the microphone so we can capture your comments in the transcript, and it's also helpful if you can give our transcriber your business

cards so we make sure that your name and affiliation are correctly reflected. WebEx participants can use the chat function to let the WebEx Coordinator know that you have a question or comment, we'll open your line at the appropriate time, and we are also accepting written comments until close of business on January 7th. And the Notice for today's workshop, which is available on the table in the foyer, and also on our website, gives the procedure for submitting those comments to the IEPR Docket. And with that, I'll turn to the dais for any opening remarks.

CHAIRMAN DOUGLAS: Good morning. Welcome, everybody and thanks for being here so late into December, relatively late into December. I'm certainly looking forward to all of the presentations and I'm looking forward to hearing from everyone here.

COMMISSIONER WEISENMILLER: Good morning. I'm Commissioner Weisenmiller. We, again, appreciate everyone's participation today, and certainly we're looking for – this is an interesting topic for us in terms of looking at how the PIER research links to the California policy objectives. Obviously, Smart Grid is very important on a national level, California is the home of Silicon Valley, we hope will drive that process, and at the same time, given the state's policy goals, particularly the goals of the new Governor-Elect, we're very interested in seeing how the Smart Grid and the

California versions of that should really be fine-tuned to deal with demand response, distributed generation, and renewable integration issues. So, again, thanks for your participation, and let's move on.

MS. KOROSEC: All right, we'll start with CAISO.

MS. SANDERS: Thank you. Good morning, Commissioner Weisenmiller, Chairman Douglas. My name is Heather Sanders and I am the Director of Smart Grid Technology and Strategy for the California ISO. I really appreciate the opportunity to share with you our recently published Smart Grid Road Map. There's been, as you all know, so much industry momentum around the Smart Grid, and with all of the aggressive energy policy goals, the ISO felt like it was time for us to really solidify our direction, at least at a high level, related to Smart Grid, and communicate this to our stakeholders and really start to engage. So, about early this year, we engaged with EPRI and Internex to support a road mapping effort for us. So, what we did is we started out with, you know, the California policy objectives, as well as the ISO objectives in mind. You know, you always hear from the ISO, first and foremost is the reliability. You know, energy policy goals will all fall by the wayside, you know, if the lights don't stay on. So, with all of the renewables, you know, a lot of this, Suzanne already mentioned, we're going to need better

visibility into what's going on at the System. We also need to ensure we utilize all the assets we have to improve the efficiency as best we can. Flexibility is also going to be very important for the ISO, as all of these variable generation resources come into the market.

You know, currently we balance the system with conventional generation, but enabling diverse resource participation by storage, by demand response, and conventional generation where needed, we'll have the flexibility to balance that variability in the most cost-effective way. And, of course, all of this has to be done in a very secure way.

So, the result of this work, this road mapping effort, our strategy really centers around five technology themes, Advanced Forecasting, Synchrophasors, Advanced Application, Cyber Security, and then a very long name, Enabling Demand Response Storage and Distributed Energy Resources. I'll talk about each of these a little bit. The goal today is to really provide you a high level view of what's in our road map document that is published. What we've included, and I've put these on the slide so you'll recognize them in the road map document, we include a vision for each of the technology areas, and then there's a description in there that describes from the ISO perspective why each of these technology areas are important. And then

a 10-year forward look on the road map. Now, we all recognize, and we did this based on the energy policy goals we have now and our understanding of the current technology and what's emerging and its current capabilities, but we fully expect this to evolve over time. You know, things are going to change, we're going to engage with stakeholders, do pilots, do research, and then adjust this through time. So, looking at advanced forecasting, I'm just going to point out a couple of highlights from each of those. You know, what the ISO needs to do is really evolve our renewable forecasting capability and also increase our visibility into the distribution system. So, wind blows, sun shines, we get generation, but we don't know when that's going to happen. And in order for the ISO to commit resources to meet the load at that time, which is now not just load that we understand, that we've understood for the last 100 years, it's load that is now affected by distributed PV that is now reducing the amount of load that the Grid sees, it is changed by the proliferation of the electric vehicles, and it's also changed by any price responsive demand. And the ISO has to be able to understand this to most effectively commit resources, so we have them available, but we also don't over-commit them, either.

So, from a forecasting perspective, you know, there's really three areas, and if you notice the different

colors, it really represents a loose grouping of activities within each of the technology themes, so wind forecasting, solar forecasting capabilities, as well as understanding how we're going to get that visibility into the proliferation of PV. I mean, there's very aggressive goals about distributed generation, as we know, so we're trying to look forward to understand how we model that in our systems.

Moving on to the synchrophasor theme again, you'll notice the vision and the 10-year look ahead on here. You know, synchrophasors provide measurements very frequently, more frequently than we have today. Synchrophasors have been around for a long time. You know, it's only now with the advancement in communications and the data processing speeds that we're able to use this data more effectively. What this can provide us is a real time view of what's happening on the grid right now. This data can also be used to trigger automated alerts to operators and, eventually, automated controls that can resolve problems before they result in widespread Grid instability.

So, once we have synchrophasor measurement devices out there, we have forecasting equipment out there, we can start to use this data in advanced Grid applications. This will help us see it better, use it better, and make sure it's reliable overall. There's a lot of possibilities in advanced Grid applications, and a couple things, you know,

there are technologies now, there is still a lot of work that needs to be done, but there are technologies now that we can understand the conditions that are going on where the transmission lines are, you know, what is the ambient temperature, what is the wind speed, what is the tension on the line. And if we can reliably get this data back in, we can dynamically rate the transmission lines, therefore, getting the most out of them at any particular time. We still have work to do on this, we need to do more research, we need to make sure it's reliable to ensure we meet all the reliability criteria, as well.

Another advanced application that is important for the ISO is to improve our what we call "regulation algorithm" or AGC, Automated Generation Control algorithms. Right now, those control algorithms help us manage frequency on a second-to-second basis. They are reactive, in nature. So, we take a state of the system, we dispatch the generators to follow that. The system is going to become more and more dynamic, including all of the renewables on there, the storage, we need to make sure that those dynamic models are built into this AGC algorithm and that it also looks ahead, that this can become a more predictive algorithm and it will closer bring the market, which is a forward looking commitment with the AGC algorithms, which right now are very reactive, so this is a very important

part of our research activity, actually, this coming year.

So, of course, the more applications you have, the more equipment out there, the more places where we have vulnerabilities. Cyber security has to be built in from the beginning. There is a lot of activity on cyber security, the National Institute of Standards and Technology, as well as the PUC proceeding right now is taking hard looks at security, and I know all of us are, as well. So, this is pretty straightforward, it is something that we all recognize needs to be there.

Finally, you know, this is the area that really comes to a lot of the energy policy goals we have right now. A standard flexible infrastructure that can really push forward, you know, the demand response and storage and distributed energy resource objectives. There's a lot going on in this area, you know, I mentioned this before, but really from a technical and a reliability perspective, the ISO has to understand how this is going to work. With what demand response could provide us, we need to work with the utilities, work with the demand response aggregators, to understand what could happen. You know, if we have everyone respond at once, that causes a frequency problem. We need to manage this, we need to understand how this could work, and how it could work together. You know, one observation is the California Clean Energy Future, you know, strongly

mentions Smart Grid technologies and how they will support the demand response objectives through dynamic pricing, and also the integration of renewable resources. So, we need to make sure that we understand how these things could happen, how they will work, so there aren't any unintended consequences. So, this is a really big area of focus for us.

So, this red map really represents our initial thinking and it's at a high level, and really what we want to do is we want to engage with all of you, we want to engage with our stakeholders, we want to understand your objectives, we want to integrate this and work all together to advance these goals. So, again, thank you very much for your time, and I look forward to future conversations.

COMMISSIONER WEISENMILLER: Hi. I have a few questions. The first one is, and actually they are combinations of process, technology, and all that. But starting out with the process one, I guess, or it's probably more of an observation, is that one of the things we need to do this year in the California Clean Energy Vision is to tee up a process for our three, or for all four of the agencies to actually spell out the Smart Grid component, and so I think it's certainly trying to put our staff and certainly the ISO and the PUC on notice that we need to start building out that overall vision there and assigning the roles and

responsibilities there. And obviously, to the extent this IEPR can provide a forum for some of that laying of the groundwork, that is at least part of my objective. I don't know if you've given much thought to how the three agencies in terms of their areas of responsibility and work here, how best can we move forward. I know there is the PUC OIR, we are seeing the framework, but also in terms of trying to make sure that what we need to do here, presuming we're PIER oriented, and what the CAISO has to do, all gets in place this year.

MS. SANDERS: Yeah, that makes a lot of sense. I think the forum, the California Clean Energy Future and the work done there, I think that's a really great place to start and, you know, as that gets built out, it will make sense to define how it fits into the IEPR.

COMMISSIONER WEISENMILLER: Now, the next question is that, as we – obviously, a lot of our PIER research is really focused on transmission. You talked about the synchrophasor part. Now, how far can we go from the synchrophasor, that system, into reading into the distribution system, to move out of transmission into distribution?

MS. SANDERS: So, how can we use the synchrophasor technology to get visibility into the distribution system?

COMMISSIONER WEISENMILLER: That is correct. Or do

we need to do adaptations or new technology to get that same sort of MRI-like tracking, not just on a transmission system, but on the distribution system, particularly as we put more and more distributed generation on the circuits.

MS. SANDERS: Yeah, I think that's a very interesting concept and, in fact, Michael Montoya from SEC is doing some of that in the demonstration project, the Smart Grid Demonstration Projects they have, and so we're very interested in how that can give us that visibility.

COMMISSIONER WEISENMILLER: Does the ISO have a sense of what circuits in California have very high levels of DG, so that we can start trying to hone in on tracking what's going on in those circuits?

MS. SANDERS: I don't know that we've done a study of that yet. I mean, we are not at the penetration levels now on the distribution circuits to have it, you know, show up. But it is something we need to take notice of, it's something that's in our minds, and it is important, and we'll be working with the IOUs to get something that makes sense for both sides, to get visibility.

COMMISSIONER WEISENMILLER: Yeah, I was told by Jim Avery that they have some circuits already that are getting to high levels, and they're seeing voltage swing, so if we can try to start identifying among the IOUs or POUs anywhere high distribution circuits – high penetration distribution

circuits, we can start trying to monitor those and see what types of issues come up.

MS. SANDERS: That makes sense.

COMMISSIONER WEISENMILLER: Okay, thanks.

MS. SANDERS: Thank you.

MR. GRAVELY: Good morning, Commissioners. Good morning, everybody here. I'm Mike Gravely from the Public Interest Energy Research Program. What I'd like to do today is just give a little bit of a lead-in to the rest of the day's session, and talk about the specific research that we're doing today and you're hearing about, and give you a little bit of insight of the schedule because each contract is on a different schedule, so you'll hear different levels of detail based on how much they've completed. For those, just a quick review, that the primary purpose today is a technology review, so this is kind of a technology process. We are going to be talking policy and questions. We envision another workshop in the spring that we'll be talking more specifically about what we've learned and how we can take this into some policy questions and research questions and GAP questions, but part of the discussion today – most of the discussion today – is going to be on how the technology looks, what technology challenges there are, what successes are coming, what areas are missing, and how that view may be different from the perspective of the large

utility, smaller utilities, and the vendors and the providers of those services. But, throughout the day, we'll talk about other PIER research in Smart Grid areas, and we're certainly willing to have some questions, if they're asked, throughout the day to answer some of those questions, and ultimately this is an opportunity for us to discuss a view looking ahead, and also to highlight as we've already begun to discuss things that we should look into, like, for example, the synchrophasors at distribution level vs. transmission level, that's a good topic for us to begin to look and see what is being done, and what should be done, as we do more and more distributed resources.

For those online and those here that aren't familiar with the PIER program, we have been around since 1996, started in 1997, we look at electricity, natural gas, and the transportation sectors, about 80 million, used on the average by 85-86 million a year. In research, there are quite a few active projects. We focus a lot on clean energy, we focus a lot on research to address the policies in California, and move us forward, so we see Smart Grid as one of the key enabling technologies, I don't think Smart Grid is the end of the road, Smart Grid in our mind is the technology that makes everything else work and brings it altogether.

Why Smart Grid is important to us, it's just a quick

summary that we use a lot in the presentations I give, it's certainly in the recent election in California, we reevaluated how important the environment is to California. Smart Grid is an enabler to allow the green grid and green technologies to operate more efficient, more effective, and better use of existing resources, as well as providing new low cost technologies that may provide more for less. We have, for example, one of the research areas that we do in the PIER Program is we look at long term research in certain areas, and the goal is to have something that is 10 times the cost, 10 times better performance, that goes out there and meets the needs so we have the opportunity to reduce costs and increase performance with technology.

Grid operations, being able to operate with distributed resources, as well as essential resources, and have better reliability than we have today. For example, one of the things people measure in reliability is not only how often you're out or down, but how long you're down and how fast you can recover, so the ultimate goal is to have less outages, when you have an outage, to recover faster, and also to be able to detect it sooner.

The big picture here today, of course, is this is all about the customers of California, and the ratepayers that are out there, making the system better for them, overall lowering the cost as we go into the future, giving

more choices to the customers, and also providing better products. We use an analogy here a lot in the cell phone arena, you know, if you look at a Smart Phone today and you say, “Is that a phone, or is it a lot more?” And most people will say a Smart Phone is a lot more than just a telephone, and so the Smart Grid, it is a lot more than just electrons flowing around the Grid.

As we mentioned earlier, we are in a real interesting time in the research community. The PIER Program, as a result of the ARRA awards nationally, there is some $8 to 10 billion, if you figure the government money plus the match money, over $1.3 billion of that is coming to California, a lot of technology demonstrations, lots of information to learn. So, one of the challenges we have is to, as you’ll hear from the utilities, is to learn from this and to move forward. So, some of the concepts today are looking at what we will learn from these different projects and how that will affect the Grid in the future.

This research that we have today actually came out of a project that we did, the report is available in a paper copy for those that are here, it is available online, the link to it is in the announcement for this workshop. So, we actually asked EPRI to look at us and say, “What are all things Smart Grid?” And this report explains all the elements of Smart Grid, it explains what some of the

challenges are and what the future view was, and as a result of that, we evolved the work we see today, and that was we really need to sit down and develop kind of a vision of how it all integrates, and we started off thinking about that we want a utility view and we want an industry view because how a utility processes things and the schedule they do, and their way of doing it is one perspective; how commercial industry and for-profit business operate and think is different also. So, we wanted to hear two different perspectives, and then merge the two to come up with kind of a consolidated or combined perspective for California. And as we got into it, we realized that the public utilities have some unique perspectives, different from large Investor-owned utilities, and so we added to that perspective the third contract, which you'll hear about today, which is going to look at the view of Smart Grid from the public utility perspective. And also, those of you who are familiar with SB 17, the Investor owned utilities have a deadline of 1 July 2011 to come up with their deployment plan, the public utilities have 1 July of 2012, so they are also part of SB 17, and they also will be developing deployment plans and road maps for each of their own utilities.

One of the important things about the presentations today and the work we've done is we didn't ask a national

question, we wanted to look at California. California is perceived by most, both nationally and internationally, as the Smart Grid state. We have a lot of very aggressive and very environmentally sensitive and customer oriented policies. The Greenhouse Gas Reduction, AB 32, the RPS Goal, the Efficiency Goals, the Distributed Generation Goals, Transportation Goals, and so we wanted our Smart Grid to support California's future view, and that would be different than other states. And when I've given this presentation all around, I always point out the fact that we have to look at where we're going. We have made decisions to install smart meters and we're installing smart meters. We have made a decision that we need more renewables and we're installing renewables, so it's important for this Smart Grid discussion you hear today, to hear how California will proceed, and other states and other agencies that look at it, it could be different for them because they may not have the same combination, but they're looking to us to lay the groundwork. And I think we've found in my travels and discussions and research that a lot of people are looking to California to help resolve some of these questions so they can follow in the footsteps of what we're doing.

Two quick challenges you'll hear a lot about, obviously the integration of renewables, this shows the wind perspective, it's one of the best charts I've seen, to show

the difference in how it affects the systems that provide the generation. On the upper left, you can see the lower parts, those systems, nuclear systems and other systems that like to just turn on and operate and not vary, and in the lower right, you see that they have to move a lot of variations, and so those are not operations that are supportive for their performance, and their long-time life, and so we need to find ways to level off those peaks with distributed assets, with storage, and other things so we can operate the Grid successfully in the future with large penetration of renewables as we do today with the smaller penetrations. So, you'll hear today about different technologies that will help us do that. And solar itself, in California we already have a lot of solar energy, but it does ramp up very fast, and it does ramp down very fast in the evening, and so, as you've heard from the ISO, that creates some challenges. If you know what's going to happen and you plan for it, that's one thing, if you know it's going to happen and it doesn't happen the way you planned, that's the second problem, and if it happens and you didn't even think about it, that's the third problem, and we have all those problems occurring with these systems, but they are all manageable and there are options of how to handle this so that we can continue. It's pretty clear, certainly in California and a lot of the country now, that the desire

to use more and more renewables is everybody's desire, and nobody seems to be backing off from that.

Just a quick understanding, so the contracts we have today, you'll hear this morning from EPRI, the three IOUs, and their contract is actually almost over, they have drafted their final report and we expect to publish that report in a few months. You will hear the details of those reports and analysis, so questions and answers, they have done their whole project, and so they should be able to provide some pretty good answers and some pretty good questions. Obviously, every time you learn something new, there may be something they would like to do, but they are at the point of wrapping up their contract and sharing everything from there, so this is a first discussion. We have a little more time because we envision one more detail and two more questions, and I would encourage people to ask questions.

In the afternoon, the contract with JPL is about half over, so they have just begun doing their stuff, they're just getting their assessments, and they're interested in feedback on what they should think about, as well as what they've done, so you'll hear a little bit about how far they're going, how they're thinking, and what they're going to do over the next several months as they complete their research and wrap up their report. And then

RW Beck, you will hear that their contract – Steve, has it been signed? I think we're really close, but – so we have a signed contract in days, so you will hear from them on what they propose to us as a plan, and they will listen and be interested to learning what the questions and issues are so they can address those, and they'll talk to you about some of the challenges that they see going forward as a spokesman in developing a centralized view for the Public Utilities. So, we'll have the three perspectives. After each discussion, there's time for questions on that particular speaker and, at the end of the day, there will be some discussions for any of the topics. And, again, if questions come up, in addition to these what kind of PIER research is going on, that may address a separate question, we'll be glad – either myself or my staff – we'll be glad to answer questions on that from there, and then we'll see. It is a Friday, which most people consider the last work day before Christmas, so I appreciate everybody around here, and we'll do our best to be efficient, but we do want to answer questions and we do want the feedback to both our staff, as well as the researchers that you'll hear from, from there. And with that, I guess I'll just do one quick thing and that is, can we get some confirmation from somebody on WebEx that they're hearing okay and we're not going to miss anything, just somebody that can type in chat that everything is okay.

I know one of our previous workshops, we had a little problem with the voice, and I wanted to be sure before we got into the discussion that everybody is okay online. Yeah, would somebody just raise your hand on the chat box, or type in the fact that the quality of the sound is okay and you're seeing the picture, just before – okay, thank you all very much. And with that, I will introduce our first speaker here.

COMMISSIONER WEISENMILLER: Okay, Mike, I had one more question for you, just to make sure we're all on the same page. Do you have a concise definition of Smart Grid?

MR. GRAVELY: Uh, well, I think – I want to answer that question by saying part of the questions that you'll hear today from the presenters is to come up with a definition of what Smart Grid is today at 2010 and what will it be in 2020. I think, in general, what we have used a lot from the research perspective, I do not believe a unified definition exists, I don't think a policy definition exists. I think, depending on who you go to, Smart Grid is everything to everybody. What we have consistently seen, though, is that the Smart Grid is a merging of the information technology communications world and the utility power industry. And one of the challenges when we first started three or four years ago, and we actually were doing Smart Grid research before it was a recognized Smart Grid,

certainly for the policy in the country was approved, is in fact one of the challenges is you have to merge the Internet protocol world with the power engineering world. And actually, I have talked with people from four or five years ago that said they would be getting a room, and people would walk out, they didn't communicate. And I think we're way beyond that now, but early on. And the standards and concepts, so the concept of how an IP standard is addressed, and how they handle problems, is not the same process that is handled for a power engineering Grid related issue. And so there were some real challenges to get the two together, but I'd have to say, there is a definition that says what it is physically, and there's a definition of what it's capable of doing. But I have seen, I can share with you from another presentation a verbal just definition of what Smart Grid is, I don't have it in this presentation, but I haven't seen two people in two presentations use the same definition yet, personally.

COMMISSIONER WEISENMILLER: Thanks, Mike.

MR. GRAVELY: I don't know if there's anybody in the audience here who has a definition that they've used in recognition, but it's probably something we might work on as what the infrastructure issue of this year's IEPR, but it's very important to do that. So, with that, I'll turn it over to Angela Chuang, who is our Project Manager for this, and

her three partners are from the three IOUs today, and so she'll be giving an overview, and all three IOUs will be speaking, and I encourage everybody online, as well as here, to ask tough questions. Thank you.

MS. CHUANG: Thank you. Good morning, Commissioners, ladies and gentlemen. It's my pleasure as Project Manager for EPRI on this project to kick off our EPRI IOU team presentation on the California Utility Vision of Smart Grid for the State of California by Year 2020, and the road map to achieve the vision.

So our presentation will be presenting the findings from our project that has been ongoing since late January this year, including a little bit about our project assumptions, the background, and the policy drivers for Smart Grid that we investigated up front, then the meat of the findings, which is the 2010 baseline for Smart Grid, the 2020 vision, and examples of technology writing those road maps to achieve the vision that we will share. Also, towards the end of our group presentation, we'll discuss policy concerns and overall conclusions and recommendations.

The overall goal of our project was to work in partnership with the California investor-owned utilities to define what is a Smart Grid for California by the year 2020, define the vision and a road map to achieve the vision, with 2010 as our baseline. The fundamental assumption is that,

given the energy policy drivers for Smart Grid are what are really driving Smart Grid in the state, that the Smart Grid vision and roadmaps that we define need to support the energy policies that exist in California. And so, that was the fundamental assumption and a requirement in our project, that the Smart Grid supports the energy policies of the state.

In order to proceed, then, we had a detailed investigation of what the policies are, and we classified – Mike Gravely had a similar slide to this – this has been updated since the initial classification of policies in our 2008 California Smart Grid Report. And it shows a number of energy policy targets in different categories from greenhouse gas emission reductions to renewable energy targets, and energy efficiency demand response type targets. Most of these on the slide are targets, some, just a few of them on this slide, are incentives. After looking at the policies in the various varieties here, our team asked, well, what about reliability? So we also added that to the slide. And, on the bottom of the slide, we can see a number of reliability reporting type activities, emergency standards for operations, and safety, and so on, and inspection and maintenance type standards. Also, the California Resource Adequacy Requirement that has been instilled a few years ago, that is also for reliability

purposes.

Our project went through a number of stages. In the beginning, we brought the leadership team together to define what are the assumptions for the project, what are the guiding principles, and what types of frameworks should we develop that we can give to the rest of our project team to fill in the details. So, we started off defining guiding principles and frameworks for our project, then we came together as a team to vet and review and provide further details for the baseline, the vision, and the technology readiness road map exercises that all three IOUs, EPRI, and some subcontractors concentrated on, in a series of workshops that spanned from April through July of this year, and we have drafted the final report and presentation that resulted from the workshop series. And we're currently under the review process prior to publication of the final report.

So, in the beginning, the first stage of the project, one of the activities we conducted was to identify the basic assumptions for the project. As mentioned earlier, the energy policy targets are met by year 2020, the existing ones. We studied them and it was just the basic assumption, that they are met. How do we define a vision road map to support those policies and targets? And another assumption is, as increasing renewable penetration markets

continue, there are certain amounts, certain types of uncertainties, that need to be managed and handled logically, and we assume they are. And that includes the ownership of the resources on the customer side, the uncertainties in the face of aging infrastructure and equipment failures which will more likely occur before that aging infrastructure is replaced, those sources of uncertainties are handled logically. And in this environmental of Smart Grid, with the customers now owning resources that could be relied on by the Grid, we assumed that rates make sense to encourage fair behavior, including customer participation by lending their resources to support the Grid, so there are rates in place that make sense to encourage the cooperation on end use.

Smart Grid accommodates market enablement and customer driven choices; this is as opposed to a traditional paradigm of utility driven type demand response and demand side activities. So, in the 2020 paradigm, the customer has choices and the markets enable those choices, and the choices are customer driven to meet their needs. Finally, that Smart Grid will accommodate the integration of alternative resources, whether it be plug-in electric vehicles, renewables on a distribution or transmission system, distributed storage, bulk storage, these alternative type of resources will be accommodated. Those are our basic

assumptions. So, we organized our project team into six areas of technical expertise which we called “domains,” domains of technical expertise, which are listed here in the first heading, the top row of this diagram, spanning from communications infrastructure and architecture domain team, to customer systems, Grid ops control, renewable and DR integration, capital asset efficiency, and workforce effectiveness. Within each of these domains, we define Smart Grid uses, broad areas of what would the Smart Grid be used for, and these are the areas that our team decided that we will focus on. There are a total of 19 of them. We developed technology readiness road maps for each of these, each of the 19, so we have 19 and we’ll provide some examples of these road maps later.

One question that is important to address besides what are the uses of a Smart Grid are, well, what’s the objective for that particular use? What’s the reason? Why are you using the Smart Grid for that? So, we categorized here, this list comes from a previous EPRI report, Possible Categories Objectives in the first column, from environmental compliance like a use to meet renewable portfolio standards, it’s for environmental compliance or to reduce greenhouse gas emissions, it’s for compliance, all the way to enhancing customer choice, improving system economics, maintaining enhanced system reliability, and

improving power quality. So, keeping the Smart Grid uses in the different 19 categories I showed earlier on the previous slide, plus these possible reasons for using the Smart Grid, we asked our team, tell us what are the top priority Smart Grid uses and associated objectives for that use. What are the top ones? And these here were almost unanimously identified by our IOU team members. For example, bulk wind and solar integration to meet RPS and reduce greenhouse gas emissions, unanimous top priority here, all the way to why there is situational and data integration for system protection restoration. The color coding here shows the different types of objectives, the green being the environmental compliance, the blue here, customer needs, that's about enhancing customer choice, and reduced peak demand, reduced losses, is about enhancing system economics. So, these are the top priority ones and this list shows the high priority Smart Grid uses and associated objectives. For example, high priority, the top priority, was basically the IOU's, most of them saying, "This is the top priority," whereas high priority is one level lower in ranking, it is "a high priority." So, this is a result for the second level of priority, for example, demand response for enhancing service innovation under capital expansion. So the use is demand response in the black, and the color coding is the type of objective. So, it ranges. And it's

interesting to note, on the previous slide, that we have PV, plug-in electric vehicle integration, the objective of that is reducing greenhouse gas emissions, for example, and meeting customer need. The meet customer need is representing the pool of the customers, they are going to go out and they're going to buy the electric vehicle, and the Grid needs to support that pool from the customer side of the market.

So, after we did that exercise, then we also wanted to make sure we covered all the bases of all the different dimensions of consideration for Smart Grid Vision and Road Mapping exercises, so we looked at – we had our technical team of great experts looking at what's operationally possible, what's physically possible with technology, and we had done the exercise of looking at the policy drivers on the top plane, and the cost benefits, as well, among the leads in our group, of Smart Grid in general terms. And this slide shows that there are many dimensions of consideration that need to be taken into account in a road mapping effort and vision exercise because the regulatory and the commercial dimensions on the top plane, they are the drivers for Smart Grid, and they determine what's probable with Smart Grid, whereas the bottom plane, the technical, the operational, the physical, that determines the means, or what's possible with Smart Grid. And together, you kind of

close the domain space of what's possible and what's probable, and so we considered all these dimensions. And these types of factors, policy regulations, technology operations, they're evolving over time, so in our road mapping exercises, we pretty much say what technology stages will occur, in what order, it's not a prediction of when exactly that will happen because there are all these evolving considerations over time that impact the actual outcome.

So, in the baseline presentation, we offer – the Baseline 2010 Presentation of our findings offers a framework to describe Smart Grid technologies. This comes from the 2008 EPRI Smart Grid study for the California Energy Commission, where we show the power system resources on the very bottom level, which starts from generation all the way down to transmission substation and distribution and end use, so this is the power level of technologies, the resources themselves, and the assets. And everything else above has to do with the logic, the remote sensing, and controls, the algorithms for controls embedded in the devices, for example, of the Grid. And the communications infrastructure that serves as a medium to take the information from the control sensors and exchange it with the data integration layer that provides one source of truth for data to the applications that require it. So everything

above the bottom level of this technology framework, everything has to do with the sensing and the controls and the logic to manage the resources. So, this can be thought of as the logic level of technologies, and the bottom is actual physical power assets. So, given that, and one other thing is that these columns represent the different parts of the electric power industry from generation to transmission distribution, and end-use. So, looking at this technology framework, we can more simply describe what is a smart grid, and from our 2008 findings, it was described as the intelligent use of information across traditional boundaries. So this one example shows the distribution operator, for example, interested in using advanced metering data to inform certain applications like outage management, for example, and that crosses traditional boundaries, and there is a lot of initial activities using advanced metering to inform distribution operations. And then, this second example we have is the Transmission Grid Operator expressing interest during our interviews back in 2008 of using advanced metering capabilities to enable demand response to balance intermittent generation on the transmission grid.

And finally, an activity with another group, also CEC funded, where the procurement team and the customer service side of the utilities working on a project with EPRI this past several years to value, to come up with a

methodology, to value how much voided cost can be captured on wholesale settlements from 1 megawatt demand response, by location, by resource. So, that project also spanned traditional boundaries. So, this is our simple one-sentence description of what a Smart Grid was, it is the intelligent use of information across traditional boundaries where every vertical line here, and every level of technology represents a traditional boundary. If there are no clarifying questions, we have our next presenter, Kevin Dasso from PG&E, who will describe the 2020 Vision Findings from –

COMMISSIONER WEISENMILLER: Okay, actually I have a few clarifying questions. First of all, when you talked about back on – I think it was slide 4 – that basically this system is dealing with the reliability standards, I just wanted to clarify that, by that, you included the NERC reliability standards?

MS. CHUANG: Categorically, that would be included, definitely.

COMMISSIONER WEISENMILLER: Okay. The next question is, on your slide under Assumptions for Projects where you talked about rates make sense, that's, I think, slide 7, again, specifically are you referring to dynamic pricing? Or what?

MS. CHUANG: Just the – not specifically, but dynamic pricing is included in the area of restructuring of

rates.

COMMISSIONER WEISENMILLER: Okay, so what are the other elements, then?

MS. CHUANG: Other possibilities of structures could be – there's things I've seen that we don't have in the U.S. that are broad, like demand subscription, for example, or alternative pricing structures, other than charging customers on the basis of energy, just energy. It could be also, for example, based on power, which you can find in CNI customer rates, all kinds of examples, those are just a few examples. But the whole space of rate restructuring is what we're referring to here, alternatives.

COMMISSIONER WEISENMILLER: Okay, now, on Slides 10 and 11, I was just trying to find – this is the top priorities, so I was trying to check on whether the integration of distributed gen is listed as a top priority.

MS. CHUANG: Yes, all kinds of distributed generation. In this area, the broad term of distributed generation, it could include PV, for example. So we have PV in the list here.

COMMISSIONER WEISENMILLER: Okay, but basically you want to make sure that distributed gen, distribution level, localized generation, is part of this vision.

MS. CHUANG Oh, definitely. It includes like electric rail and electric – integration of PV, example

here, to reduce greenhouse gas emissions, there is PV, we looked at CHP, as well, different types of generation in our ranking exercises.

COMMISSIONER WEISENMILLER: Okay, and last question is, as you go through the Smart Grid definition and vision, was there agreement among the California Utilities and you on what the hardware and software pieces of that are, or would be, in terms of how to translate the vision and goals into specifics?

MS. CHUANG: We would like to present some examples of that in our Technology Road Map exercise examples later on, but, yes.

COMMISSIONER WEISENMILLER: Okay, that's fine. Thanks.

MS. CHUANG: Kevin Dasso from PG&E is up next.

MR. DASSO: Good morning, everybody. My name is Kevin Dasso. I'm PG&E's Senior Director of Smart Grid and Technology Integration. I'm happy to be with all of you this morning. So, I'm going to talk a little bit about the vision, kind of building off of what Angela laid out in terms of some of the introductions. This is a tag team presentation, so I'll be handing it back to Angela and we'll hear from the other team members as we go forward.

So, in terms of 2020 vision, one of the first things that we did was really to take a look at what have others

said about Smart Grid. So, I think it was alluded to by Mr. Gravely that, you know, many people have definitions of Smart Grid, they've taken positions on it, so we thought it would be useful to just do an inventory and at least say – get an understanding of what are the characteristics that various organizations have put out there, that we ought to be thinking about and that California ought to be thinking about as it looks at its development of its 2020 vision. And one of the aspects of any time you talk about Smart Grid and the vision around that is, it is useful to think about characteristics which are different from what the actual Smart Grid is versus what it can enable, and so I think some of the language which needs to be – you have to think about that a little bit. And we've tried to parse that out as we've gone through this.

So what we've put up on this slide is just three examples of kind of listings of Smart Grid characteristics that have been put out there, the first is EPRI's view and EPRI's membership in terms of how they see the Smart Grid, what those characteristics are, the second is really coming from the DOE and their modern Grid strategy development work, and then the third is essentially some of the characteristics that have been described by the California Public Utilities Commission in the ongoing Smart Grid OIR, which built very much on the characteristics that were

described in Senate Bill 17 that is kind of driving, you know, at least State policy as it relates to Smart Grid characteristics. So, there are a couple key themes here that I wanted to point out. The first is around reliability, so we've got, you know, self-healing, resilient, higher quality power, reduced impacts on outages, so reliability is a theme. The second is customer enablement and customer participation, so those are expectations in terms of characteristics. The next one is around markets, so enabling markets and making markets more robust, that's a component, a characteristic. Integrating renewable resources at all levels, so bulk system as well as distribution system. And then, last but not least, it needs to be secure, so secure from a Grid perspective, but also secure from a customer information perspective, those are, again, some of the characteristics that we considered as we developed our vision.

This is the actual vision statement, and I'm going to read it first, but I'm going to break it down a little bit; the vision statements can be a little dense and I think it's worth kind of identifying the key components to this. So, I'll just read it off first. The Smart Grid will link electricity with communications and computer control to create a highly automated, responsive, and resilient power delivery system that will both optimize service and empower

customers to make informed energy decisions. So, a lot there, and I'll kind of break it down a little bit, but first I wanted the focus on is what is the Smart Grid, so I think Commissioner Weisenmiller, your question, you know, do we have a concise definition of the Smart Grid? Well, what is it? It really is the linking of electricity with communications and computer control, so that is the what, or that is the what is the Smart Grid. The second part of this vision statement also goes to how does the Smart Grid accomplish what we're setting it out to do. And the how is that we're highly automated, responsive, and resilient, as we think about the Smart Grid. And then, the last part is around benefits, so why do you do this? You know, what are the benefits and there are many but we characterized them really in two basic statements, that is, to optimize service and also to empower consumers, that those are the main elements.

And I want to just talk a little bit about optimizing service for a second. There are many demands that are being placed on the Grid going forward, so we've touched on some of those already. New requirements, so more intermittent resources, distributed resources, electrification of transportation, those are all things that can be enabled in multiple ways. We believe that the Smart Grid is about how to optimize that, enabling those new

services while still considering costs and reliability, overall. So, there is this, I think, important concept here of optimization and, you know, the balancing of those elements.

And then, again, the last point here, but clearly not the least, is that consumers are really at the heart of all of this, so how can we help consumers make good choices, have control over their energy usage going forward? So that's the vision statement that we've used and developed and would offer for consideration here.

The last point I'm going to make, or the last slide I'm going to cover is, again, kind of going to the capabilities that we highlighted as investor-owned utilities to focus on. Again, the Smart Grid, and there are many capabilities that can be enabled by the Smart Grid, and I often hear people talk about all the things that it can do. I think that if we really wanted to take a shot at trying to prioritize those, you know, you really don't want to try to do everything. If you try to do everything, you're probably not going to do very much. So we really wanted to focus this around what are those key capabilities that we're after. And so the first is around empowering consumers in the open market. So, again, that's a key theme, lots of things you could do, these are things that we think are important. The second is, you know, very much front and

center for California, and that is, you know, renewable resources. And, again, distributed, as well as bulk system. The third bullet is, you know, kind of one of my favorite themes here and that is don't forget about the Grid, you know, that there are elements of this that, as we think about capabilities, that we can't forget about, in our drive to integrate renewables and enable customers, there are some grid elements that we have to think about, and that is around reliability, around economic efficiency, and around security, and in the face of very complex and changing environment.

And then, last, again, from the utilities' perspective, we also need to focus on how can we increase safety and productivity of our utility workforce to the benefit of our customers and providing a safe environment for our customers. So, those are kind of the key capabilities that we wanted to highlight. So, those are my prepared remarks and if you wanted to ask a few questions, we can do that, and then I'll hand it back to Angela to cover the next section.

COMMISSIONER WEISENMILLER: That would be great, thanks Kevin. I had a couple of questions. If you go back to the Vision Summary for a second. I guess my question to Mike and to Heather is whether both of you agree with that definition.

MR. DASSO: I'll yield to Mike.

MR. GRAVELY: I would say it has all the elements that we've talked about. I have to be honest with you, we haven't really taken – you'll hear different perspectives today a little bit from this, but it has all the elements we've discussed. Well, this is the utility perspective, I would say it has a utility perspective.

COMMISSIONER WEISENMILLER: Okay.

MR. GRAVELY: I would say if you had a vendor provide this, and maybe – I don't think we're going to talk about it – but it certainly provides all the information, but I would have to say that it is, in my eyes, through the eyes of the utility vs. the eyes of the customer vs. the eyes of someone else. So, we haven't actually vetted it out, but it certainly has all of the elements that we consider critical for Smart Grid.

COMMISSIONER WEISENMILLER: Okay, Heather?

MS. SANDERS: I would agree with Mike. The one thing I would add to this is the visibility aspect, you know, the automated response of resilient power delivery system, as well as the optimization is very important, but I would just add the visibility aspect to this.

COMMISSIONER WEISENMILLER: That's good, thank you. Okay, Kevin –

MR. DASSO: Can I respond, maybe I'll address

Heather's point.

COMMISSIONER WEISENMILLER: Sure.

MR. DASSO: So, in resilient, I think we have that notion, I mean, in order to know what to do and be capable of responding, you have to have visibility, so that's an element of it.

COMMISSIONER WEISENMILLER: Kevin, in terms of the PG&E circuits, are there any distribution circuits that, at this stage, have very high levels of DG?

MR. DASSO: We do have a number of distribution circuits that have a large number -- of distributed generation or PV, in particular?

COMMISSIONER WEISENMILLER: Yeah, PV in particular.

MR. DASSO: We do. We have not – we don't have any circuits where the penetration has created huge concerns yet, however, we have approximately 42,000 customer-owned solar panels located in our distribution system, kind of throughout our service territory. Those panels tend to be concentrated in certain areas, particular neighborhoods, subdivisions, and so on. We're beginning to see some of the impacts of those high concentrations, but at a very localized level. We're not seeing them causing any problems at a circuit level, the issues are a little bit more localized. However, these are concentrated in certain areas, some circuits have a lot more of those units than

others do and we know which those are.

COMMISSIONER WEISENMILLER: Yeah, no, my impression was that PG&E has really led the nation in solar PV installations on the DG, so in terms of looking for data, I'm assuming if anyone has circuits that are very high penetration rates, it would be PG&E.

MR. DASSO: We do have a rich database. I think one of the challenges we have, though, is that today, in the way those PV units were installed, or today and historically, is many of those are a net metering kind of arrangement, so we do not generally have visibility into what those PV units are doing, and so that's an area we'd like to leverage and expect to leverage some of our Smart Meter capabilities to get a better understanding of going forward. We know where they are, we know what they're supposed to be doing, we can see the implications of them on our grid from our side, however, we can't tell you at any given time what is the output of that unit, and is it performing at the level it was expected. Those, I think, are future enhancements that we would expect to be able to add to that database.

COMMISSIONER WEISENMILLER: Did you have a sense of what the highest penetration rates you have on these circuits?

MR. DASSO: By number or –

COMMISSIONER WEISENMILLER: Percentage.

MR. DASSO: Percentage, generally less than 10 percent of the capability, we have not reached that. At a circuit level, we do have certain segments of those circuits where the penetration, or where the actual PV output is greater than 10 percent of the peak demand.

COMMISSIONER WEISENMILLER : Yeah, I guess the last question for you is, having been sort of Ground Zero on the Smart Meter installation, coming from those lessons learned, what are your takeaways for the Smart Grid?

MR. DASSO: I think one of the key elements is how to engage customers, I think that's – we have been on the cutting edge of all of that, and to some extent the bleeding edge in some of that area. I think we've learned a lot of lessons, we are applying those lessons going forward, I think, with a very different type of response. We have a very expansive outreach program now before we go into communities where we have been reaching out almost two months before we install any of the meters with elected officials, with various consumer groups, we're coming in with answer centers, with displays, and ways in which we can inform customers about how they can use these devices, and I think with a much different outcome. A couple things I would like to mention, you know, kind of highlight there that often get lost in all of the energy around PG&E Smart Meter Program, we have over six million Smart Meters that

are fully enabled, meaning that they're being used for billing, they can support communication with customers about what's happening on their usage. We have over 250,000 customers that are accessing, or have accessed, their hourly data through Smart Meters via our PG&E website, so people are beginning to use those tools. One of the other features that we think is kind of neat and interesting is that, with the Smart Meters, the interval billing capability, that we're able to use hourly data and inform customers when they are about to reach – as they move into a higher cost tier, we call it "tier alerts," we have over 20,000 customers that have signed up for tier alerts over this last year and we're getting positive feedback on that. So, again, there are benefits and things that are being enabled here.

COMMISIONER WEISENMILLER: I guess the other issue, obviously you've been hit with the concern on health issues, and, again, looking back at that issue, is there anything else we should worry about in the Smart Grid context?

MR. DASSO: Well, again, I think there's lessons to be learned. You know, the wireless communications is one of the components and elements that we have to think about. If we're going to be talking with, whether they are Smart Meters, or whether they're sensors or other devices, you know, out distributed in the distribution system, depending how deeply they go, the most economic, cost-effective, and

safe, we believe, and many also believe, way to do that is through wireless capabilities. And I think we do have to make sure we're addressing consumers' concerns and answering those to the best of our ability.

COMMISSIONER WEISENMILLER: Okay.

MR. DASSO: Thanks. I think this goes back to Angela.

MS. CHUANG: So we have a few technology readiness road map examples to share. The ones chosen, for example, because we have 19 of these in the final report, but we decided to share the ones more on the customer side because it reflects more of the newer capabilities of the Smart Grid. For example, plug-in electric vehicle integration technology readiness road map. Each stage here in the row is reflective of a certain level of capability and we start in the short term, which means the next five years, so through 2014, we move to the medium term, which is the next five years after that, and then the long term means 2020 on out. So, the first stage in this area of PEV integration is going to be all about Smart charging, about handling the vehicle as a load. So, the capabilities there include off-peak charging, demand response, down regulation as opposed to up because it's about turning it off when it's on, it's about managing the load from the electric vehicle when it's charging. And then, the stage after that in the medium term

with the vehicles to home, using the battery of the electric vehicle to support electricity uses in the home, just locally, and then, in the long term, getting vehicle to grid, which is using the battery, then also to be able to also support the Grid, which involves another level of complexity when we allow export of power to the Grid to support it. And, finally, renewables integration, which is about using the battery of the vehicle to support the Grid, to balance fluctuations in intermittent renewable generation, which is an additional level of complexity because of the intermittent nature that needs to be handled. So, those are the stages and the basic capabilities. The enablers to reach each of the stages are listed on the right-most column. So, for Smart charging, we need bi-directional communications, for example, between the grid and the vehicle, standards to be able to support the Smart charging, and we need implementations to test standards and so on. The vehicle to home requires bi-directional power transfer on-board the vehicle, and a proven value proposition to do vehicle to home. And you can see that repeated, the proven value proposition to do vehicle to grid, for example, is a key enabler in the long term, as well as to support intermittent renewable generation.

Just some examples, the next one we'd like to share is demand response readiness, integrating demand response,

what are the stages for that in the next 10 years. So, today, we have reliability-based demand response programs, that's part of the baseline. And in that, we just listed here to contrast with the subsequent stages, so DR, Demand Response triggered emergencies, system emergencies, and other critical conditions where the trigger uses is some kind of system-level emergency condition to trigger the demand response. And we need – we do equipment retrofits, we have to enable communications and remote control capabilities today, we do that. And we have customer adoption and program participation to increase program participation as a key enabler. The energy market integration is in the short term, where we have activities today to get to integrating demand response with wholesale electricity – energy markets of wholesale electricity markets. So, to do this, we need DR to be triggered based on wholesale energy prices, so we're working towards that in the day ahead, or day of, so energy-based trigger. And to do that, the key enabler would be tariff approval for some kind of dynamic energy pricing, energy-based pricing for retail customers. And this requires two ways, smart end-use devices – I'm sorry, one way communications for energy-based triggering, one-way communications, not two-way yet. The next stage in the medium term includes distribution management system integration, where basically now we have

localized event conditions being detected and triggers based on local conditions, let's say distribution system conditions, so using demand response to support the distribution system, let's say preventing a distribution transformer from overloading, for example. So, DR in this stage can be used to extend facility and asset life, and PEV charging is one example here, to avoid the transformer overloads. We need Smart end-use devices with two-way communications to get to this stage, as a key enabler. I mentioned localized event triggers; also, tariff approval for perhaps demand-based retail rates, and the PEV charging is an example for that, where the value of demand is very – it's something that will need to be addressed. The ancillary service market integration is also in the medium term, so we're talking 2015 to 2020, reaching this stage. DR is providing operating reserves to support Grid operations in this medium term stage, and to get to this stage, we need Smart end-use devices with integrated communications and controls, some kind of cost justification for the telemetry requirements, the monitoring requirements that are required by the Independent System Operator to provide operating reserves. The cost needs to be justified because the requirements are more stringent, or the requirements need to be relaxed, or some combination, and some cost allocation method if the market participant

decides to sell supply reserves using DR, for example. And then, finally renewable integration, the most complex level in this roadmap, we're not just using PEV, but any type of DR to help balance the intermittency of bulk renewable generation, for example, or even distributed renewable generation. So, to get to this stage, deep situational awareness, Smart end-use devices with the capability of rapid automated response, that's in the long term – 2020 on out. And we have one example on the Grid side, and many of our technology readiness roadmaps, whether it be at the distribution or transmission level of preparing the grid side, it has a basic trend of, we need the ability to monitor remotely those resources on the distribution system, for example, whether it be electric vehicles, or other types of demand side resources, and have that capability integrated with existing SCADA systems, for example, so that the operators can make decisions, have the visibility, make the decisions, and further down the line have the advance protection control capabilities in place to operate the Grid with these distributed resources, including customer-side resources and intermittent resources, so the proper protections and controls in place, then the ability to operate with some level of automation and advance applications, the general trend.

We would like to cover policy issues and

recommendations and conclusions and leave enough time for that, so our next speaker is Mike Montoya from SCE.

MR. MONTOYA: Good morning, everybody. My name is Mike Montoya. I'm a Director of Grid Advancement for Southern California Edison. And I want to talk a little bit about what the team thought about as we went through this whole process on the policy issues as we go forward between now and 2020.

So, we broke it down into three different areas, the regulatory role, who should be doing what, the deployment pace, when you think about between now and 2020, in a couple of weeks we're going to have less than 10 years to go through all of this and really shore ourselves up such that we can meet all of those goals and make sure the technologies that we use are capable of meeting those policy goals. And then, the customer readiness, you know, it's been alluded to that customers are going to be very very important in this piece, there are a lot of goals around the Smart Meter arena that are around demand response and other issues that the customers are going to have to be very well informed and be a part of this in order for it to be successful.

So, around the regulatory role, we think the jurisdictional clarity is going to be very very important because of the fact that the Smart Grid is going to

encompass so much from the transmission level, bulk power, wider controls, and distribution substation automation, field area networks for our field workers, and asset utilization, and all the way to the home area network where our customers are going to be involved. And when you think about just the utility piece of that, there is so much integration, and we think that end-to-end security is paramount for that integration. And then, on top of that, you hear folks, including the Chairman at FERC say that one day I will be able to bid my washing machine into the ISO market. And so, when you expand that into the millions of devices, if that were to come to fruition, the integration of this really needs to be at a national level such that the standards are for all of us and all of the different manufacturers are all building to the same standard so that we have an interoperable system and the capabilities for, you know, like the computer world, where there is plug and play.

And another issue around the regulatory role is all the IOUs are in different places in Smart Grid, and that is all driven by different business reasons, but as policies are developed and as they move forward, that should be a consideration such that it doesn't put one company in a bad situation and another company in a better situation, so that should be taken into consideration. And then our customers,

as we develop policies, they're all different, they all have different needs, and so we need to at least have that Litmus test to make sure that we're not doing something that was really unreasonable from a cost perspective or technology perspective for a certain customer that doesn't need those different technologies. And then, the notion of least cost, best fit, when you think about all these policies that we're going to have to meet by 2020, we can do it brute force, you can invest in different types of investment to try and do it brute force, or you can look at it from a technological perspective and see if the technologies will help us accomplish those 2020 policies. And when you go into that arena, you're going to be dealing with a lot of new technologies, a lot of things that you'll look at in the lab, you'll look at when you first start deploying, but as you scale that whole Smart Grid across your system and you get more variable energy out there, you know, you may find that it doesn't scale, or other issues as you go through the technology, and so these thing will be the least cost – and because there's going to be some uncertainty as we go forward.

On the deployment pace, as I say, one of the areas that we think should be avoided is for regulators and others not to mandate or pick winners. In other words, we shouldn't be regulating one technology, or that one

technology vendor would have an advantage in that arena. This should really be across the board, let the market and the vendors, and the experts and the systems, look at what the best fit and what technology is best for us to be able to accomplish the goals.

And then, I kind of alluded to it before, but there is a need for treatment of emerging technologies from a contingency perspective when technology may not scale, or technology may not perform like you thought it would in the laboratory, or if you get out there and the generation or the different technologies that are going to be interconnected with the Grid don't play the way you think they would. And then, I think Kevin mentioned this, is that we need to remember as we go through this thing, that we still need to have a reliable system and that we really want to make sure that our customers are served properly with a reliable service, while trying to achieve these goals.

And then, on the customer perspective, we need to really make sure that there are incentives out there and outreach programs that will really get them engaged to help us meet these goals, they are going to be a big part of it, and so we really have to ensure that they come along with us. On the third-party access to this, I think everybody in the room knows that there's a lot of other folks looking into getting into this business, you know, you have the

Googles and the Microsofts of the world looking at how they could maybe help our customers, you know, reduce their costs through better information and technologies, so one of the things we think is very important is that the customer privacy issues should be very important as we develop these policies, and make sure that the customer not only understands what's going on, but agrees that their information goes out.

And the last point is that the customer needs to anticipate that the future electric costs are probably going to go up because of the policy goals, but that if we do this right, with the right technologies, and we're very thoughtful about it, they will not go up as much as the brute force way of doing things. And so, in summary, that's just kind of the areas we think as we go through this whole journey from now to 2020, these are the areas we think should be kept upfront and in mind as we develop future policies. Thank you.

COMMISSIONER WEISENMILLER: Yeah, Mike, a couple policy questions. One of them is, obviously, as we rolled out the Smart Meters, they've been more or less utility by utility, and I guess part of the question is, are we at a stage, you know, if you look vs. having meters rolled out on a utility basis versus, say, nationwide, presumably the cost would be driven down, the more we can get the common

technology. But then, part of the issue is, for this area of innovation, you're not quite sure what the [quote unquote] "winners" are. So, the question in part is, how do we do the right balance between continuing to encourage innovation at sort of the local level, while at the same time trying to achieve some economies and cross communication at the state and the national level.

MR. MONTOYA: Well, I think when you look at technology, in general, manufacturers are going to build two standards, and so if you have a national standard, you're going to have a lot more manufacturers building to that than if you have individual state standards, and the costs would be much higher if you had individual standards because, you know, they're building X for California and Y for Wyoming, and all that. So, I think it's important to keep that in mind, you know, the manufacturers are going to build towards standards and if we can have a standard that is interoperable and goes along the way of plug and play, I think that will help us with economies of scale and bring the costs down.

COMMISSIONER WEISENMILLER: Good. Do you have a sense of what a reasonable estimate of the timing to get there will be on the national standards?

MR. MONTOYA: Well, it depends which one you're talking about. We're working, all the utilities and all the

stakeholders are working on the standard for the communications, for instance, on the Smart Meters, on the Home Area Networks, and so, you know, it's been worked on for a year or so and it's probably going to be worked on through the summer of 2011. We're anticipating that that's when it will be finalized. But there are a lot of other different areas out there that are being reviewed by NIST and, so, each one of those individually will take its time to get there.

COMMISSIONER WEISENMILLER: Yeah, I was going to ask the harder question, if you think about what are the central functions for Smart Grid, then the question is, when will we have those standards in place for at least the central pieces of the puzzle?

MR. MONTOYA: Well, it depends on the technology again, but if you look at communications standards, a lot of those are already in place. If you look at communications within the substations as an example of that, IEC 61850 is a standard today, and utilizing that, which is our intent when we move forward on our automation, so if you look at it from that perspective and you pick the standards that are in place today, and that they're interoperable, the whole thing is interoperability here because you're going to have the Home Area Network that's going to influence, you know, the controls at the highest levels on the system eventually when

you have enough penetration. And so, what we need to keep in mind is interoperability and security as we go forward with the technologies that we do.

COMMISSIONER WEISENMILLER: Just the last question, in terms of Edison's distribution system, what are your experiences at this point in terms of PV installations? Are you finding it similar to Kevin? I assume you don't have as many PV systems out, at least not as many affected circuits? Is that right?

MR. MONTOYA: Yeah, that's correct. One of the things that we do have that's a little different is we have to install 100 megawatts of solar rooftop PV per year for the next five years. And what we're finding is that the roofs that are big enough to handle a one or two megawatt PV array are few and far between, and they're usually clustered. And so, as we've looked at the queue of where these PV arrays are going to be installed, or are proposed to be installed, we're finding, you know, a 10 megawatt circuit that as a queue in it with 21 megawatts of PV. So, what we've done is we've actually developed some models and we've done a lot of modeling of the PV inverters, we've actually physically tested the inverters to verify the models, and we're finding some interesting things like very high voltages when the inverters and the solar are isolated with the low loads, and so we're looking at what is the best

way to really achieve the controls that are going to be necessary for the higher penetrations of the solar PV. We're taking the view that we're going to try and make it successful to integrate all of that PV and other PV, so we're looking at tools to help us do that.

COMMISSIONER WEISENMILLER: That's great.

MR. MONTOYA: Okay, now I'd like to introduce Lee Krevat from San Diego Gas and Electric.

MR. KREVAT: All right, thank you very much for welcoming me here. I'm going to talk about some conclusions and recommendations, a lot of which you have already heard spread throughout not only this EPRI presentation, but the earlier presentations from this morning. So, feel free to ask questions if I need to clarify anything that I say or that is up on the slides.

As we talked about probably that the main driver of a lot of what we are doing in Smart Grid right now are the energy policy goals, you know, all the IOUs have seen that there are issues, even asking about distributed generation and photovoltaics. At the end of 2009, we had 10 circuits of our approximately 900 that have – this is just San Diego – for example, 20 percent or more, with five having 40 percent or more at certain times of photovoltaics. So, we are already seeing various types of issues. We're starting to use different types of sensors, we have plans to use

synchrophasors to measure what's happening so we have some data with that, and we think we have a couple of solutions coming online to smooth out that intermittency on the distribution level, although that is going to be harder to do as it becomes more and more circuits over time. A second driver that has really come on strong over the past year to two years is really empowering the consumers to take advantage of more open markets, so, because the Smart Meters are out there, we're approaching two million in probably a month from now, but we'll take two million out of our 2.3, so we're closing in on completion here. Our customers are hearing more and more, and I think all IOUs have this, where they understand that the data is out there, so now they're starting to say, "What are we going to do with the data?" Various consumer advocacy groups are asking, "What can we do with the data?" So, it's really driven very quickly Smart Grid investment into that area and, again, all the IOUs are working in conjunction to move in that area. I will say what is exciting about the process that we did is that the utilities, the major utilities in California, are all very much, although we're doing different things and for different reasons, because of what is evolving in our Grids, we are in the same direction. There is nothing that we absolutely disagreed about, it was really more fine tuning to get statements we could all come to agreement on, and

that is a very good thing since we are trying to get standards and not having to individually shoulder the burden of all of the advancements we're trying to make. I was in New York last week and a New York Commissioner spoke about no desire to go first, and instead to just look at California. So I think it's really important that, while the rest of the country – it may not be moving like we are, but we at least in California are in sync.

Another big thing to come out of not necessarily just this effort, I'll give a lot of credit to the SB 17 effort to put together a Deployment Plan, is that in addition to the different utilities looking together, the domains within each specific utility are working together more than ever. Really, at the beginning of this effort, each domain customer, service provider, or transmission distribution operations really looked at it from a very within their domain perspective as to what they wanted to do as they went forward. And as we're trying to build a cohesive road map across the different domains, it has forced us to get all the players together in the room and talk about solutions and how they impact different domains with the utility, and it's exciting to go from a few number of people that really have that kind of broad knowledge to, through discussion, having a much larger number of people within the utility that understand how the different parts

of the utility work together.

And then, and you've heard the benefit areas that we've talked about, it is a concern of all of ours that people might think that this is all going to be about cost payback, and some of the projects will lower costs, without a doubt, but many of the projects we're doing, you know, the benefits lie in continuing to provide reliable energy in the face of great change. And also, something that has been talked about very much today is the national security perspective of having distributed generation and being able to leverage it in case transmission-based energy is lost in some amount of time, also a benefit of the Smart Grid.

So, recommendations, you asked a question earlier, Commissioner, about how we avoid – this is how I interpreted the question, you can correct me – at one point, we have an urgent need to move forward because we have these – our customers have goals to be able to leverage their data and save costs, we have the energy policy goals which are also customer driven, as we've seen, and we have the reliability goals out there, so our customers also, it looks like, and in California we have a huge number of orders for Nissan Leafs, I think about 40 percent are California, of all the orders that were made, so this is really about the customer and we do have an issue with – it's coming on fast, but we don't have the standards in place. And, really, the answer

there is to be careful and to start doing these demonstration projects where we do try to get out in front and understand how this is going to work, and I would caution that it's not going to be perfect, we are going to make mistakes. I think each utility probably has some directions they've moved in that they've had to back out of in order – because they went a little too fast, although there were reasons that we went that fast, we had to solve issues, so some of those solutions didn't work out as well as we wanted, and we've had to re-do some programs, but we want to minimize that. And even if you choose right, I'll give an example, not the Beta Max VHS, I'll use VHS and CDs, you know, so VHS was a standard, the price was driven down, you could buy a VCR for under $50.00, but still, eventually came a better technology. So, we're never going to expect that, just because we say something is a standard, it isn't going to prevent a better technology to come along. So we're going to see that also and that's going to create some issues because where utility assets are there for a long time, it's likely that, while we're happy with the technology we've chosen, while it does become a standard, that there might be following standards that we won't be able to take advantage of as soon as we want because of what we put in early.

Also, I already pointed out, I guess the video

technology, if you look at number nine, as far as leveraging experiences from other industries, so you really could look at any industry where technology, digital technology, has come into play, and it's really totally changed that industry, so we're certainly looking at Telecom, but we're really looking at a number of industries beyond Telecom where standards played a big role. Also, where competition played a big role, we haven't talked about that much, but it's certainly clear that advancements in technology from a distributed generation perspective, storage, other energy resources, fuel cells, for example, are going to bring some – have already started to bring, and will continue to bring, more and more competition to the energy industry.

So, really, again, I think as has been said a number of times, but the Smart Grid is not the energy policy, but if we're going to meet the energy policy that we have, as well as just customer facing empowerment policies and meet our reliability goals, then we really need Smart Grid to make advancements quickly, and by the way, we've put these road maps together, but in our experiences, every time we take a new look at our road map for the next 10 years, we haven't pushed anything back yet, and things continually are moving up. In the last year, we moved maybe 40 percent now of our road map up five years. Two years ago, people weren't talking about electric vehicles, they weren't

talking about customer data, they weren't talking about managing that with an iPhone and an iPad because there wasn't an iPhone or an iPad. So, this is really moving fast and will continue to move fast, which is why we're not really trying to make a prediction or a forecast of exactly what this going to look like, but we are trying to put a vision out there, a road map that we can use as a guide, understanding that it's going to change a lot as we move forward.

And then the last caution is just the three IOUs for really good reasons are focusing on different aspects of the Smart Grids, in some places we're looking at doing it the same way, or similar ways, but I think that's good because that also brings innovation and, when we see one of the other utilities do something, this is really – I should say it's globally – we just met recently with Country Energy in Australia, and actually it's them, that they have a potential solution for the intermittency on the distribution side, so I think it's healthy to talk to other utilities. But within California, because we're kind of in the same place, I will say, I know PG&E struggled with their deployment, I think that, if you look, they have a lot of customers now getting their data, looking at their data, getting alerts, so it's also very positive story there if you choose to look at the positive. And even another

positive, while it might not feel like it, PG&E, Edison, and San Diego Gas & Electric got to look at results based on how they did certain things, and we were able to learn from it. And I think that we have to all be open to sharing our mistakes so that we can learn from each other and not repeat them.

COMMISSIONER WEISENMILLER: Thank you. I have three areas I want to talk about. One is, of the Nissan Leaf, what percentage of those are in San Diego? My impression is you guys are really focused on trying to be a leader there.

MR. KREVAT: Yes. So we have an approximate number from Nissan, they have not committed to this number. And they may deny giving it to me, but approximately 2,000, so about 10 percent of the Leafs nationally. I know that, supposedly, on the 23rd of December, or next week, there's another shipment coming of Leafs down to San Diego and another one soon after that.

COMMISSIONER WEISENMILLER: And how are you dealing with the potential for multiple vehicles on a single circuit?

MR. KREVAT: Yeah, so, when I was ordering my Leaf, my daughters were with me and my teenager, who is 17, who I'm looking for a used car for said, "Dad, get me one also." So it wouldn't have been the same, you know, transformer, we live in the same house, and I was telling that story to a

San Diego organization, and the head of that organization said she was looking at buying two, as well. So I think these are real issues that are going to happen and what we're doing now is we're actually leveraging the Smart Meter data that we have hourly, so we're looking at a transformer and the meters that are attached to that transformer, adding up the hourly data hour by hour, and therefore building a load profile for each transformer. And from that, we have already gotten data that shows some transformers on the hottest day of the year are over 200 percent capacity already, a number are at over 150 percent. So, if you look at that data, and then you're aware of an electric vehicle and someone signs up for an EV rate, calls us up as part of the process, then we'll be able to apply that predictive data to that load profile on a hot day and see where we're going to have issues. And luckily, even though there are a lot coming, we will have some time as it ramps up to learn and continue to improve the process.

COMMISSIONER WEISENMILLER: Good. Another question, a lot of the electric system historically has had depreciation over many decades, depreciation schedules over many decades, and still in use 50 or 60 years later, where obviously your iPhone or whatever has got a much shorter life. What sort of depreciation schedule are you using for the more computer electronic aspects of the Smart Grid? Or

what would you suggest?

MR. KREVAT: Okay, that's a difficult question. What we are trying to – we have a project called "Grid Com" which is basically a wireless cloud over San Diego, and so we're trying to build it out so that the communications aspect is modular and depreciate that over five to seven years, whereas the parts that we expect to last longer were depreciating over a more traditional length of time and in some areas we can't do that, and with the Smart Meter, that's difficult to do the Smart Meter, I think it's a 17-year depreciation on that product.

COMMISSIONER WEISENMILLER: And I guess, historically, it was about 30 for the old meters?

MR KREVAT: I believe so. And the software on the back end, that's more of the – I think we're going for seven or 10 years on the software on the back end, and the hardware five years or seven years for a refresh, so different aspects of the system, different timelines.

COMMISSIONER WEISENMILLER: That's good. Obviously, we've looked at lot at Smart Grid implications for the electric system. As a joint gas and electric system, you know, is there any synergism here with your gas pipeline system and distribution system, elements that you can and should be rolling out there?

MR. KREVAT: And so we're investigating that now,

especially, again, with Grid Com coming into play, we'll have communications systems. So, we're looking into how we can leverage technology. If you look at the definition, it could apply to gas, we're just trying to find some of those positive benefit implications for our customers, trying to identify those. But we already do have a piece, our gas – in order to get the benefits from not having to read meters manually, we have gas modules on our gas meters that communicate with the electric meters. So, in a way, we're already having it touch our gas system.

COMMISSIONER WEISENMILLER: I was at a hearing last week in San Bruno on that incident and I was trying to figure out also if there are any implications of Smart Grid for those types of concerns.

MR. KREVAT: Well, I will say we are looking – I can't go into details because we haven't really figured our investigation, but we are looking at how to be able to measure more remotely and respond to things, you know, leveraging – again, it's about applying digital technology to the Grid. And that could apply to other grids, as well.

COMMISSIONER WEISENMILLER: Okay, thanks.

MR. KREVAT: Thank you.

MR. GRAVELY: So we have a few minutes, if there are burning questions in the room here, I would say for online, if you have questions and would type in the questions, we

can potentially address those at the very beginning of the second hour after lunch. Is there anybody here who would like to talk to the utilities or Angela about their project at all? Okay, we'll break for lunch. If you have questions, give them to myself or Suzanne, maybe we'll start with just a couple questions beginning at the next session, but we'll come back and we'll hear from -- after lunch at 1:00, we'll reconvene and we'll hear the other two technology road map statuses. Thank you very much.

(Off the record at 11:59 a.m.)

(Back on the record at 1:06 p.m.)

MR. GRAVELY: Go ahead, Merwin.

MR. BROWN: Okay, thank you. I'm Merwin Brown with the California Institute for Energy and Environment with University of California. And the question I'm asking combines a number of points that I heard in the presentation, so it doesn't necessarily go to any one point. And what's behind this question is trying to get a sense of the urgency for the development of new technologies for the Smart Grid, and perhaps this also goes to the need for changing certain policies, but that's not my direct interest, it's the new technologies in order to meet the State's energy policy goals, particularly renewable integration by 2020. And there were some points made that I'd like to follow-up on. One of them was that, in the road

map, it showed demand response not really being utilized until after 2020. And also, a comment was made that, if we had to, we could meet those goals with brute force which I interpret to mean sort of we would build our way out of this problem with the traditional transmission lines, distributions lines, traditional power plants, using traditional old technology. And I guess I would ask the question, how comfortable or confident are we that, one, we won't need demand response before 2020, and that we won't need these other new technologies, that we will find it increasingly difficult and expensive to try to build our way to meeting the 2020 goals? And, again, I'm asking the question in the context of is there a sense of urgency that perhaps the road map doesn't bring to bear on new technology development.

MR. GRAVELY: Angela can help me, but I've read the chart to say that the DR's ancillary service was in your five to 10 year window, not your after 20-year window, so it was a medium – not a short term, but a medium, so it would still be prior to 2020, but not necessarily right away. Is that correct?

MR. BROWN: I'll take the demand response out of the question, but I still have the one about the brute force. Can we build our way out of this problem?

MR. GRAVELY: Right, so anybody want to address

that? So I'll help a little bit from my exposure with them before, and that is, I think we realize from the California perspective, permitting and other things, that the brute force approach will work only in a dire emergency and a small amount of the problem, so I suspect we will – and Commissioner Weisenmiller, I do think over lunch your question about the vision, and I would say, as we go into the next presentation, I think the piece that I saw that wasn't clear there was the desire and a vision of the Smart Grid creating opportunity for commercial growth, creating opportunity for new products, and encouraging the expansion and growth of the commercial market, so we're going to actually start now hearing a little bit more from the vendors and the commercial side, but I would say most of the vendors I've talked to, if we developed a vision in the state, they would like that vision to include a desire or a goal to open the market up for competition to allow commercial products to grow and thrive, so that we actually take that extra step, as opposed to just take what comes. And with that, I'd like to turn it over to, I guess, David is speaking today here? There are a couple of people here from the Jet Propulsion Lab. So a reminder in this case that they're about half way through their contracts, so they have begun research, they are holding many of the technical discussions, and they have begun to formulate their

information, so you have the ability to influence them, but they may not have all the answers to questions you have.

MR. TRALLI: Thanks, Mike. It's my privilege to represent the perspective of the manufacturers and vendors on our team. The title of our project as we proposed it was "Road Mapping the California Smart Grid through Risk Retirement." Risk Retirement is a term that we used in the Aerospace industry to define the set of actions that one must do in the course of a program or project to mitigate or move those risks to your requirements, to meeting your requirements. So, one of the things I want to say before we get started is how do we know as a community that we have met our goals of 2020? How do we know that we've met our goals of 2020? How do we know that we have the Smart Grid that we thought we would? And how do we know over the next decade that we're making progress towards meeting that 2020 Smart Grid?

So, I'm proud of listing everybody who contributed to this study because it shows the amount of interest that we have from this community in giving their perspectives to what we were doing. It was our responsibility as a project lead to gather all this information and put it in a manner that makes sense and that is quite a challenge and we are in the middle of that. We've held three workshops, one in Pasadena, one in Sacramento, and one in Washington, D.C.,

and we have an incredible amount of information. A lot of these companies were members of our trade organizations that are part of our project advisory committee through the American Council on Renewable Energy and the Electrical Manufacturers Association, and then also the Gas Technology institute. So, what we have here is some preliminary findings and recommendations from what we've been able to put together for the purposes of today's joint workshop.

The Commissioner asked a question at the beginning that we share the view that we have to offer a definition of Smart Grid in any conversation or presentation on Smart Grid. This is the one that we went with in our proposal which is attributed to Austin Energy: "Smart Grid is the seamless integration of electric grid, communications network, and necessary software and hardware to monitor, control, and manage the generation, transmission, distribution, storage, and consumption of energy by any customer type, industrial, commercial, residential." But more than that, for us, it also encompasses the integration of renewable energy and electric vehicles, and also reflects the importance of appropriate policy, regulations, and standards.

Now, while I will not talk specifically about policy and regulations, I will say that our first workshop back in June, most of the time of that two-day workshop, was spent

on looking at issues and barriers related to regulations that might get in the way to meeting these targets, and that will all be part of the final report.

So the landscape, as we see it is this, that major changes are need in the electric and the natural gas infrastructure to meet the anticipated energy needs and to address climate issues in the next decade and beyond. The key point in natural gas is the fact that it is a major component in the distributed generation space, and we'll talk about that. The concept of the Smart Grid is driving the development of advanced energy conversion, storage, and reliable power delivery technologies and also the integration of renewable resources and more efficient grid operations. And this last point, that clean transportation and greenhouse gas emissions from the grid itself also forces us to examine our efficiency and consumption considerations, this points to the California loading order, that you don't just look at clean supply, that we need to start by reducing consumption and garnering greater efficiencies.

Our vision is this, luckily this wasn't a business school exercise of seven words or less: "Reduction in energy consumption and greenhouse gases from electricity production and clean transportation are linked to provide electricity producers, distributors, and consumers with

options for their preferred business models and operations choices, means that we need to have sustainable, cost-effective, secure, and reliable solutions that not only must be developed, but demonstrated in the field, matured, and then implemented." So, we start pointing to the natural progression of technology maturation and technology risk reduction through the demonstrations and scale-ups so that we can engender commercialization not only first year risk reduction by the Government and the State, but also investment from the investment community.

We feel that a new paradigm is evolving where generation, storage, and control are more distributed, along with attendant modification to grid interconnections. Commissioner had a lot of questions on distributed generation, which we'll talk about. And in terms of enabling that distributed generation, we feel that microgrids are at the heart of this paradigm, providing co-generation options with integration of renewables, including rooftop PV systems and combined heat and power, while also enabling options for reduced consumption through such things as demand aggregation, distributed storage, EV accommodation, and ultimately net zero buildings with the 2020 residential target. This will ultimately lead to a Smart Grid that provides the ratepayer with a greater voice in energy flexibility, efficient operations, and cost

structures. Some of these elements have been touched upon in the morning sessions.

So, in terms of generating our baseline for 2020, there were some key technologies which I'll list in a couple of slides that we asked our project members to define for us, not only the current state of technology, but what technology is going to be in 2020, and how do we get from 2010 to 2020. It's what they call their current state in these various key technologies that we're defining as part of our 2010 baseline. I won't read them all, but solar and wind integration, on the solar side, we have the CSI, you guys can look this up in the presentation package, in demand aggregation you have some very early projects in net zero buildings that touch a little bit on that, or demand management zones, which we'll talk about later. Distribution automation, there is a lot of proprietary products developed by a small number of OEM's, and there's research needed to see how much this AMI with all these meters out there can be suitable for stretching distribution automation applications beyond the substation, more to the meter part. Government is leading a lot of the development of standards and the control and protection products and deployment like transmission communication systems and AMI, and these are snapshots from our project team.

EV accommodation, there is a lot of technology

factors and a lot of load impacts that have been mentioned, and a lot of this needs to evolve, it obviously needs advancements in battery technology, charging infrastructure, and also that communications and control that enables the accommodation of EVs on the Grid. In net zero construction, you have the start of distributed generation at the community residential level, energy efficiency, tax credits, distribution generation, energy efficiency, AMI and control, again, for proprietary products, by a small number of OEM vendors, some source proprietary technology by smaller numbers. A lot of discussion on bandwidth issues and mesh networks and options there, and the communication space, large and small vendors, government leading standards, and customer benefit is not really clear.

And then microgrids, three different scales, substation level like in the Maui project, feeder level like DOD 29 Palms with GE, multi-facility direct load control, and single facility, like a project going on in British Canada. So, we can start seeing things happening, but our message really, as you'll see, is that we need to look at the Smart Grid as a system, and see how we can better integrate all these demonstrations and stuff towards meeting the 2020 target. Lastly here, storage. There is some storage starting to meet daily electrical demands, energy storage is derived from the shifting of energy production

from load demand periods to high demand periods, pumped hydro-compressed air, steam generator options, and we need development of more options for large-scale stationary storage and lithium ions, ultra capacitors, flywheels, there is a flywheel company in California, a recipient of Stimulus funding, in Mike's list, in his presentation, flow batteries. So, that's kind of our snapshot of some key technologies 2020.

In terms of microgrids, our definition of microgrids really refers to a document, a CEC report of 2007, a joint workshop between CEC and Department of Energy in 2007, where the microgrid was defined as an integrated power delivery system consisting of interconnected loads and distributed energy resources, often with its own storage. This connects with the Grid or macro-grid, so you have an interconnect there, integrated DR, it's capable of providing continuous energy to a significant portion of the internal load. The Grid possesses independent controls and can island from the larger Grid. I think there is a lot of discussion of options of the Microgrid as an architectural option for what we're trying to accomplish. The Microgrid is an architectural option for enabling distributed generation. It's an option for modularity, for introducing technologies out of modular levels so that we can then replace them with more advanced technologies as the years go on, as Lee

pointed out from San Diego Gas & Electric. It also offers more control, possibly more of a security risk, maybe it minimizes the number of interconnections with the Grid, but I think another interesting thing that we need to look at with microgrids is from the point that Mike mentioned when he introduced me, which is from the perspective of generating new business and new market opportunities and capabilities that we can develop in the state as a fleet leader not only for the nation, but exporting capabilities that we know in the Third World and in other parts, microgrids are the way that they're going to go because they don't have the old electric power infrastructure that we have in this country, that we have to maintain, while we also re-architect things to meet a 2020 goal.

So this report is available online, I recommend that you take a look at that, it's 2007. How do we get there? This was the key question. The Smart Grid we recognize is an engineering system whose complexities not only span technological and operational issues, but obviously policy, regulatory market, and social factors. And the discipline that we're trying to bring into this study and onward is to plan for the design development, deployment, and sustainability, by looking at what those top level requirements of the Smart Grid are. Those top level requirements are given to us by the IEPR, okay, and we'll

get to that. So, advanced energy conversion storage, reliable delivery, renewable resources, clean transportations in the form of EVs are all integral to that system architecture. And we must not forget that the expectations and benefits to the ratepayer must also be part of that optimal solution. So the risk retirement is a system level enterprise that we need to do through an integrated series of key demonstration projects. We're going to start in the next three years by looking at the progress of all those projects on Mike's list that are taking place in California, a lot of those are in placement of advanced meters, some of them are energy storage, there is one that is looking at flywheels, and we need to see where all that stuff takes us and to find over the next 10 years what additional risk reduction demonstrations we need that tie back to all the objectives that we have from the IEPR, so that we know we're getting to where we need to be in 2020. So, these demonstrations are to identify, prioritize, mitigate, and systematically buy down the risks of key technology and Smart Grid subsystem areas, and it is for validation and verification of integrated systems within the Smart Grid. Not only did you ask the question, did we do what we wanted to do, but are we doing the right thing to get to 2020 and beyond? So, these demonstrations, assessments, and evaluations look at technical performance

and cost, they look at controls and interfaces, interoperability, they look at the possibility of scale-up, safety, reliability and security, codes and standards, business model feasibility for the utilities, for the vendors, for the consumer, market transformation needs, and the leveraging between applications. And again, as was mentioned earlier, the lessons learned, lessons learned amongst and between utilities, technology developers, and the ratepayer. We benchmark, we develop best practices, we learn from that, and we march to the 2020 target and beyond.

So, as part of our study, we designed a couple dozen questions that we offered to ACORE on our project advisory committee and they distributed this to their membership, 214 people participated, and these are just a sample of the questions and the answers that came from that membership survey. The greatest barrier to establishment of the Smart Grid, 1) lack of consumer knowledge and education; I think we've seen that before; potential loss of consumer autonomy and control, that was a concern; not enough financial incentives, which of course we know; and then, no regulatory regulation. In the interest of time, I won't read these sub-bullets, but we can talk later, you obviously have a copy of the presentation online. What are the three most important technologies for Smart Grid implementation and why? Control and communications, of course, is big;

advanced metering infrastructure, which of course we are moving forward with that; and then, the integration of photovoltaics and wind, and storage for firming up intermittent resources.

Study approach. Basically, as the project lead on this, we wanted to rely on the input of a wide range of Smart Grid technology manufacturers and vendors through a series of workshops and surveys, and continual e-mail and exchanges and discussions, and to develop the top down system engineering approach to road mapping or proscribing what the key actions need to be to meet the objectives. I will share with you key technologies and use cases. We've held some workshops and the underlying engine of process to what we're doing, which we're not going to talk about today, is that Risk Retirement approach of understanding, what are our high level objectives, which are coming, and you should know them, and we listed it through workshops, what are the risks and barriers at all levels? Physical, functional, market, operational, regulatory, okay, that are in the way or potentially in the way of meeting those objectives, and then what do we do to mitigate those objectives in time so that the more we beat down those risks or buy down those risks through demonstrations, the more we know that we are attaining the objectives set forth.

So, the key technologies that came out of our

workshops were storage, rooftop PV, demand aggregation, the biomass base CHP, microgrids, CCUBE, Command Communications and Control, distribution automation, AMI, EV accommodation, and integration of solar and wind towards meeting the RPS targets. We defined six use cases which are the core of maybe defining some interesting, or pulling together some interesting future demonstration projects around the role of natural gas and DG for CHP, combined with biomass, looking at command and control, and distribution automation, including what we can do with AMI, communications and control for the accommodation of plug-in hybrids and plug-in electric vehicles, biosources, biomass as part of the RPS target with a proscribed target for biosources and for fuel cells for energy storage and working with CHP, and then large scale storage to firm up wind and solar. The policy goals are these nine – it's kind of funny that there are question marks – those should be 1 through 9, that's not me. So these are the ones that we pulled out of the IEPR, these are the ones that the top down system analysis speaks to. We have to do things that we can link through our system, have something to do with doing a better job of attaining these objectives to 2020 and beyond. And then we also looked at six additional objectives that came out of a DOE study for their Smart Grid work, but we're really speaking to these top nine here.

So what we did here, and we can talk about this later, we have the charts up on the wall behind the Commissioner, but what we wanted to do was develop a framework for our roadmaps, and I think somebody, I think it was Angela that said, you know, we have road maps for different technologies. I don't think we're going to have a singular roadmap because there's going be a series or suite of roadmaps where each one of these key technology areas are core components of the Smart Grid system. But what we did is identify the fact that we have the reduced consumption side, and then we have the clean supply side, okay? And that pays attention to the loading order in the State. And down the middle comes the existing infrastructure, this is a timeline from left to right. Down the middle is the existing infrastructure of the electric grid and the natural gas distribution grid. And so, what we noticed was that out of those nine objectives, there are not nine independent objectives, they are nestled, you start with number one as 33 percent RPS; we have small hydro, we have geothermal, we have centralized PV, centralized wind, we have biomass, but now within that, there's a specific target for biomass in the IEPR, and there's a specific target of 5.4 gigawatt increase in CHP, and the biomass is linked to the CHP, and the CHP is linked to natural gas to supplement biogas generation. And then you have rooftop PV. Rooftop PV is

part of reaching a solar renewable target, and so these PV, CHP, biomass, are increasingly distributed, and how do we enable and accommodate those distributed energy resources into the utility grid? Well, one architectural option is microgrids, and that is something we want to look at.

On the consumption side, or demand side, there's overall reduction target, a target and reduced consumption overall, there is reductions in peak demand, there is the ability to meet that peak demand through demand response, either dynamic pricing signals, voluntary programs, or something exercised by the utilities. Then, you also have efficient production, distribution, net zero construction, this notion of demand management zones, net zero construction that is kind of stalled right now because of the state of the real estate market and the economy, so we need to understand where these things are going to start happening and how they're related. And then you have EV accommodation. EV accommodation that will put a load on the grid, EV for resident storage, for frequency regulation, how is this all going to play out, and how do we accommodate electric vehicles? And microgrids, multiple scales – commercial, industrial, residential. Where do we need to do Risk Retirement demonstrations so that we know that these demonstrations address multiple targets, and one demonstration is linked to the other and related to the

other, and make an assessment midstream, like five years from now, to see how we're doing, where do we need to re-architect, and where do we move forward on to 2020?

So, the preliminary findings were that barriers cited by our industry partners are not exclusively technical, they are economic, financial, regulatory, and social. Stimulus funding is good, but it's not enough to overcome the lack of capital needed for large scale deployment. Distribution grids are not set up to evolve into grids or microgrids, there will be increased opportunities for physical attacks, modularity, microgrids, breaking up the grid into smaller chunks affords you a lot of benefit on one hand, but also introduces other portals for cyber threats, so that needs to be traded off. Time of use retail pricing changes that interface between retail and wholesale market systems, and then Smart Grid system models that look at all the stakeholders are badly needed. I think it was Recommendation 6 out of SDG&E that said we need to look at architectural options and look at things as systems to systems, we couldn't agree more. And there is much development needed in storage.

Energy storage is needed for a variety of Smart Grid applications, peak shaving, bar support, renewable energy integration, electric vehicles, frequency regulation, and islanding – islanding, that is another benefit, perhaps,

that if you have a potential brown-out or something, you can maybe control it in near or real time from cascading by just breaking things down in to localized load and supply domains. Distributed generation in combination with distributed storage offers many opportunities to achieve greatest efficiency and operational benefits. Biomass for reducing greenhouse gasses, and the interplay with that, with natural gas a clean fossil fuel in the CHP, and the impact and benefits of electric vehicles. I will move on. This was through a discussion with folks we know at General Motors, the primary goals of OEM's, of course they have to develop a product that is saleable and welcomed in the marketplace. Everybody knows that we want to reduce our dependency on oil and reduce greenhouse gas emissions, there is the whole issue of charging standards and interfacing with the grid.

Impact on the grid – you must integrate with the Smart Grid infrastructure with minimal effort and expense, so there is a lot of communications and control issues that need to come in there, on top of the issue that we talked about earlier, which is, if the electric vehicles are very clustered, they put a load onto the circuit, that creates a problem, so how are we going to manage that. And other uses for EV's, I won't get into this because I'm probably out of time soon.

Let's see, Incentives. We need to incentivize the consumers to engage in Smart Grid related activities, maybe some joint projects between the ratepayers and utilities, utilities and industrials and commercials, conduct studies and analyses, education campaigns, we saw that earlier today, conduct additional demonstration projects for Smart Grid functions and Smart Grid elements under the context of a complex system, microgrid demos of which there are some already in-state. Let's see, ensure that regulations do not unbalance value propositions, EERS for the net zero issue, and others here. So, these are all documented. Energy storage, lack of appropriate energy storage was the most frequently mentioned technological barrier towards meeting the Smart Grid related goals by supplier representatives at our workshop, that's how we would use storage.

Recommendation – California should undertake a carefully planned campaign to address the need for language updates and tariffs and standards to ensure proper evaluation of storage and a range of Smart Grid applications. Let's see, energy storage – incorporation of energy storage and microgrid operations, coupled with microgrids, and then looking at this. Let me mention that, on the electric vehicle accommodation, our lead for that was General Electric, who also provided some stuff on the communications and controls for accommodation for Electric

Vehicles. National Electrical Manufacturers Association took a cut at distribution, automation, and demand management zones. We have A123 Systems on the team that helped us with some of these stationary storage barriers and ideas, Fuel Cell Energy on the combined heat and power space for load following stuff, base load, supply, and I'll show you a representative example. Gas Technology Institute also on the CHP and microgrid arena, Sun Power on the rooftop PV, and a host of others that were part of Slide 2. Microgrids -- very much interested, the industry participants in the project, in looking at the microgrid as an architectural option for meeting the California goals. And there is some stuff in there that I certainly would like to understand. I mean, does the microgrid – I'll just throw that out there as a question – are there architectural options that engender more business than market development opportunities for the state and attendant job creation and capabilities for manufacturing in the state, that can also be exported nationally for the national grid, and abroad across the Pacific where there is going to be a lot of growth in this? So, it's another, you know, architectural options are not just technical and physical, okay, they are functional, operational, market driven, economic, and so, when you do the tradeoff analysis, you're not just focused on technical performance and cost, but all these other issues, and so is

this an architectural option that would leverage more of the things that we're trying to do?

Microgrids are inhibited right now from growth because of the readiness of the consumers, system knowledge, the need for more system architectural trades, recommendation 6 of the EPRI Report, stuff that we're trying to do here, energy storage, looking at issues and regulations and standards for communications, interoperability, and the availability of financial arrangements. Okay, stimulus funding is good, it reduces the first tier of risk and technologies that need to be rapidly commercialized, marketed, and scaled up, so what are the analogs to clean technologies, to biotech and IT of the previous Silicon Valley runs that the state has had? We need to understand that, okay, and that is part of the trade-off space, as I mentioned last. And, again, lastly, which was I think mentioned in the modularity discussion by Lee and I think alluded to by Merwin as understand that the Grid and the technology that supports it is not static, things will be evolving, technology will be maturing, and how do we best do that and not lock ourselves into options right now that are going to be costly to replace, albeit better in the future as we move to 2020? And microgrids for looking at operational efficiency, and maybe some customer benefit issues of microgrids that are worth looking at, and

the details are – and microgrids, here you go, maybe this is the system of systems, okay? You have nuclear base load, remote solar, remote wind, hydropower remote, with some microgrid options more at the industrial, commercial, residential level, integrated with the utility, third-party ownership, controls, interconnections, all that stuff needs to be worked out, but those are the things that we would recommend be looked at. Demand Response – no clear cut ownership preference, utility, customer, or third-party demand aggregator, this came out of discussions in our workshops, and we need to carry out further studies to see if further actions are needed to focus on investment and development efforts to define specific forms of demand response management – who is responsible for it, what are the best ways of addressing market forces there? And then, this is just an example provided to us by Fuel Cell Energy, putting together capabilities that address base load and address load following capabilities to firm up wind on one side, but to use the wind power to maybe electrolyze the water, generate hydrogen as a storage option, and that also takes hydrogen co-generated from a larger scale biogas facility, and use that to feed the load following system, or instead of the electrolyzer, you can put a stationary battery system. What I like about this demonstration, if you look at the checkmarks, is that it allows you to

integrate intermittent resources, it helps you meet that number one target. It provides flexible fuel options, not only on the renewable side, but it's a play for natural gas, which we're trying to accommodate. There's no fuel consumption in the spinning reserve state, it reduces that, it's efficient, it's zero emissions goal number nine, bringing back our GHG's to 1990 levels, it offers a rapid load following capability of distribution automation, super peaking, distributed gen, so these are the kinds of projects and systems – I'll use that word, systems or components, that we need to look at, so that we're not just looking at storage, or we're not just looking at one piece, but we start looking at integrating what we need to do, so that we develop the California Smart Grid as a system in the next decade. This is where we're at. We're going to explore deeper in two or three architectural options and look at some key system tradeoffs, space domains like the biomass, CHP, industrial scale, 10 megawatt microgrids, look at hydrogen for storage, fuel cells, or even for transportation for that matter, and demand aggregation, demand management zones that the commercial, residential, microgrid area, net zero buildings, there is some interesting stuff coming out in the press from Wal-Mart and their interest in microgrids and putting systems on their roofs and parking lots, which is really intriguing, electric vehicle accommodation, the

command control structures there for the additional load for using that as additional storage for frequency regulation. What we're trying to do also in the second bullet is, some of these objectives from the IEPR are very numeric, you know, 33 percent, well, we can go back and look at the database at the state, we know how much we're generating from renewables, and we know how much we're using biomass, and we know what we're doing in CHP, so, as you're moving forward, we need to know the systems that we're putting in place and maturing into the grid, we need to know how much energy we're supplying with that and we need to know where the demand is, and so we're trying to put together a model that allows us to say that we're retiring the risks and those risks are linked to those objectives, it points to actions or activities that we know in an energy balanced sense how much energy we're putting in CHP, biomass, RPS, solar rooftop, how much we're reducing consumption, how much we've reduced peak demand, things like that. So, we're exploring that, and then we're going to offer a recommendation of Risk Retirement demonstrations that integrate various key technologies like I've listed, and a suite of key technologies that address more than one IEPR goal, that would be ideal, and to do those one, or two, or three year centers as we recommended in our framework and timeline, so that we can then put up all these key

technology road maps to understand how everything is related at any given point in time, over the next decade. I like what Angela does – short term, midterm, long term, understand where are we towards meeting every single one of those nine objectives. Our final report, including recommendations for research development demonstration, and also some thoughts on integrating the three perspectives, we started back in June, so nine month study, something like that, we're looking to wrap up some time in March, maybe a month after that. But it's been an incredible project because, as you can see from the list of project participants, the amount of information, not only that is available on the Web, but the amount of information that vendors have provided us is, frankly, overwhelming. And to make some sense of that in terms of meeting what the objectives of the study is, you know, where are we, where we do we want to be, what is the vision for 2020 under this group of people, and how do we get there and how do we give the State, not only the Energy Commission, but the Utilities Commission, a process, a method, a tool, where you can see this is how we're meeting those objectives, and pull together, you know, the IOU's, the MOU's and the vendor community, that is exciting, but it is difficult, no doubt about it. So, that's where we are. I'd be happy to answer questions or meet with you afterwards, but that's the

snapshot for now.

COMMISSIONER WEISENMILLER: The only question I had was on page 12, on the ACORE slide, where did demand response come? You listed top three, but where was that? Was that number four, or was it lower, or what?

MR. TRALLI: On the ACORE questionnaire?

COMMISSIONER WEISENMILLER: Yes.

MR. TRALLI: I don't –

COMMISSIONER WEISENMILLER: "Important Technologies."

MR. TRALLI: Oh, on the Key Technologies?

COMMISSIONER WEISENMILLER: "Important Technologies," it's your slide 12.

MR. TRALLI: Slide 12 is that one, right?

COMMISSIONER WEISENMILLER: Yeah, so where –

MR. TRALLI: Oh, okay, yeah, right, we had like, I don't know, a dozen and a half or two dozen questions that we forwarded to ACORE and ACORE forwarded that to their membership, this synopsis, this just happens to be question 6, this was – we received this from ACORE. I would have to go back and see what the attendant questions were that touched on demand response, that's not under here.

COMMISSIONER WEISENMILLER: Okay, thanks.

MR. TRALLI: It's not to say that it's not, we'd have to go look.

COMMISSIONER WEISENMILLER: Okay, thank you.

MR. GRAVELY: Questions from the audience? Anybody online, if you want, would you raise your hand real quick before we go to the next speaker? Anybody interested -- we'll have a question and answer session after the next presentation also, so there will be an opportunity. Now we'll hear from the public utilities perspective. Again, as I mentioned, RW Beck and Steve Rupp will be presenting that, and his will be presenting basically the successful proposal they submitted to the Commission, it was a competitive award, as were all three of these, and what their plans are and some other challenges going forward, and anything he's learned today, he wants to inquire about. Steve?

MR. RUPP: Well, good afternoon and we very much appreciate the opportunity to be in the company of so darn many smart people. I'm going to try to not cover ground that's been covered before with the excellent work that our friends in the investor-owned utility space and friends in the industrial space have covered, but I think, you know, we've got the benefit of starting last, and I think that's a really good position to be in, in this space. Tons and tons of lessons learned, tons and more lessons to be learned in the coming weeks, months and years about how we really navigate our way through the Smart Grid future that we're facing. We're really excited about the challenge that's

before us and I think, to kind of summarize it quickly, you know, we've got 29 and growing, different voices that reflect California's interest in energy and how Smart Grid might change our energy future, and that's in our community-based utilities. This is a very interesting population of decision-makers and service providers to work with, they're extraordinarily diverse. We've got folks that are small electric only service providers serving maybe a few thousand customers in a very rural setting, to whom demand response really isn't a relevant topic to discuss, to whom changing the way that they go out and read meters is really not very exciting because they see that process of interacting with their customers as being vital to the service that they provide in their community. So, that's one end of the spectrum. At another point in this place, we have utilities that are providing telecommunications, natural gas, electricity, and water to their community, and to them this whole question about Smart Grid looks very different than it does to our traditional electric utilities. We've got leaders and followers, we've got folks like SMUD and Glendale, Santa Clara, that are really advancing the technology of Smart Grid. We've got folks that haven't even started thinking about it. And in the middle is where most of our states' publicly owned utilities, they're in a pack watching and waiting carefully to understand which direction

the tide is going to flow, so they can make a decision that is going to provide the greatest benefit and the least impact to their communities.

So we've got now a challenge before us, which is to bring 29 different voices to the table and try to coalesce their interests into a road map that helps get to the vision that I don't think any of them disagree with in terms of the importance of achieving these policy objectives that we've set out in IEPR, like trying to make a decision to travel from the far northern part of the state to the far southern part of the state, there's a lot of ways to do it, you can take an airplane and get there quickly, or you can take back roads on your bicycle and spend a couple years doing it. And that's, I think, really what's going to test the robustness of any road map that we come up with out of this process is, is there a path that works for everybody that is at the table. And to the extent that we can help Mike and his people on the research side understand where to apply their energy and their efforts in making sure that the paths are free of roadblocks and that they're able to advance the ability of these paths to provide an efficient course for folks to navigate their way through the Smart Grid, then we will have done our job. So that's kind of how we see trying to bring together the POU perspective.

Again, covering a lot of ground that's been covered

before in terms of what the vision is, I'm not going to go into that because we've articulated it really clearly. We see the project as having three really important real goals, 1) to try to develop a broadly shared and supported vision of the Smart Grid for 2020, one that not only encompasses the distinct difference between investor-owned utilities and community-owned utilities, and one that addresses the interests of not just the service providers, but also the technology providers, as well as one that reflects 29 different types of utilities in the state. It's going to be a real challenge, we've got some strategies around how to do it; 2) coming up with what really is the core of the road map, and that is a technology and a program assessment framework that allows utilities large and small to try to find a path that's going to work best for them and their owner ratepayers, if we can accomplish that, then I think we've really done the best service that we can do, and we'll go into the presentation here and tell you a little bit about how we're going to do that; finally, building with the other efforts in the research project, we've got to come up with a real coalesced, comprehensive road map that's going to work for everybody, so hopefully we can accomplish those three important goals.

We talked about this ad nauseum, about how the state's energy landscape is changing, what's really

important, so I'm not going to belabor that. I think what's important, though, to touch on is, particularly around issues like greenhouse gas reduction, the community-owned utilities is a great example of local government at work, you've got utility boards and city councils who see it upon themselves to set policies and make determinations about the direction of their community that's not only aligned with what the broader state and nation want to do, but really reflect the individual desires, interests, at once of the folks that are in the community. And with that, you see when you look at the state's publicly owned utilities, you've got some folks that are more aggressive than what the state vision is, and you've got folks who are much less aggressive than what the state vision is, in terms of things like greenhouse gas reduction. You've got utilities who are committed to rolling back their reductions to a greater degree, and sooner than what AB 32 would have, and you have utilities that are scratching their head, wondering how they're ever going to accomplish that when they're dependent upon carbon-based fuels to provide cheap power to their customers. So it's going to be a very interesting task to navigate.

We talked about this, we've got to come up with a common POU vision, which doesn't mean we have to have everybody in agreement about what we're going to do, we just

need to be able to get through a highly collaborative process, 29 different voices to the table, that can contribute to the state's plans to go and rely on Smart Grid to achieve important energy efficiency improvements, important integration of distributed renewable resources, and these things that, in my opinion, are realities that utilities have to embrace, they just need to find a way to do it that allows them to meet their commitments to their customer ratepayers.

Our process, you know, we've got to engage the State's publicly owned utilities, we've got to get them to collaborate, we've got planned a series of stakeholder processes that both the IOUs and JPL and their team had to go through, and I hope to learn a lot about how to do that well by working with them, and then, again, come up with a road map that is going to return value back to the utilities that are depending on us to help provide that kind of direction.

We've laid out a very detailed project approach, working with the staff here at the Energy Commission, and the publicly owned utilities who will be involved in it, it's flexible, it's adaptable, it's not yet set in stone, but generally it's built on this idea of a stakeholder group that is our vehicle for collaboration, focusing on developing a framework around evaluating the technologies

that we've define as Smart Grid, and understanding how to measure and predict the impact of those technologies on achieving important goals, and understanding at what risk and at what cost, so that that can be formulated into the decision, and in the end coming up with a road map that leads to the vision that has a path on it for all of the different utilities.

Our schedule, we're just getting started, we expect to be wrapped up by mid-summer. We'll be last to start, last to finish, and look forward to doing as good a job as our friends at JPL, PG&E, Edison and San Diego have done. So, I'm beginning, so we don't have a lot of pithy content for you yet, but I'm happy to answer any questions about our approach that I can.

COMMISSIONER WEISENMILLER: Yeah, thank you, just a couple of questions, one is, in terms of the POUs at this point, are there any utilities, say, a SMUD, or an LADWP, which have put together already a road map for their Smart Grid efforts?

MR. RUPP: There's a broad spectrum of road maps that are out there. You'll find road maps that Glendale has completed, a fairly comprehensive road map, Burbank is not quite as far along, but further than most, SMUD, of course, is way down the road, they have a very clear vision, and it was very well articulated in the Smart Sacramento project,

the State's largest Smart Grid implementation grant through the ARRA Stimulus program, so you've got, again, a great example of folks that have very highly evolved thinking about Smart Grid in terms of both their objectives and the timelines and the costs and the expected benefits of getting there. You know, we've got a lot of utilities. In fact, I would say most of the State's POUs haven't started yet.

COMMISSIONER WEISENMILLER: And one of the challenges, I think, for you, is the basic question of how much of these components, hardware or software, really have economies of scale which could certainly affect what is optimal for your Grid vs. your LADWP, say.

MR. RUPP: That's a great point, and it's a problem that really is not particularly unique to California's publicly owned utilities, you know, you could look across the country at how this challenge plagues utilities who want to make moves in the directions that you've seen the larger ones doing -- Austin Energy, SMUD -- but they can't afford to do it, they can't afford to take the risk around technology obsolescence, the economies of scale aren't there, and it does become a challenge. So, some examples of – I can tell you about that utilities are taking to overcome those challenges, as our publicly owned utilities have done for many years, when they get into the economies of scale challenge, they begin to combine forces. And so, a joint

action becomes a vehicle through which publicly owned utilities can accomplish these broader objectives with least impact on their community ratepayers, or their owner ratepayers.

COMMISSIONER WEISENMILLER: Yeah, I guess the final one, certainly along with the economies of scale question, typically you have a much lower cost of capital, so in theory, at least, for more capital intensive technologies might be more attractive for you as opposed to the IOUs.

MR. RUPP: That, taken on its own face, is absolutely true, the cost of capital tends to be more attractive for publicly owned utilities, but you have to look at capital expenditures in the context of a broader equation that relates to what you're willing to charge customers for your product, and many publicly owned utilities put the cost of energy as number one by a large gap over any other requirement that's important, and so then it becomes not just the cost of capital that's important, but spending any capital, and understanding, really, what is the return of that investment to their ratepayers. So, it is, you know, certainly cheaper for a publicly owned utility to go out and borrow money from time to time and that's not entirely true for every publicly owned utility, but, taken by itself, it's not really an indicator that it's an advantage for them in this context.

COMMISSIONER WEISENMILLER: Thanks.

MR. GRAVELY: Questions from the audience here?

MR. TRALLI: This is a question looking nine months from now when we start integrating your study into ours. I think I read that the MOUs or POUs, they're subject to different rules or whatever for power generation. You guys can own your own power generation assets, whereas the IOUs cannot since the deregulation – or what's the difference on the power generation side between the POUs and IOUs, and where you see some, in an overall statewide Smart Grid, where do you see the overlap on that side alone, the gen side with the IOUs and the technology community?

MR. RUPP: Well, so it's interesting, and you can look at it from a couple of different directions, and I don't know that there is one answer, and I know for sure there is no short answer to it. If we look at it from what's relevant to this dialogue, which is distributed generation, there really is no difference. A municipal or publicly owned utility can go out and own a small utility scale or a rooftop scale distributed generation resource, just like an investor-owned utility could – zero difference. You know, the differences around owning assets, I think, changes as you begin to start talking about larger and larger and larger assets, and how that fits into the regulations in the State of California. But I think it's

also true that, you know, I'm sure I'll find out if I'm wrong here, but I do believe that all of our State's investor-owned utilities still own generation, maybe not as much as they used to, but they all still owned, and they're all still building and developing new generation assets. So, again, I don't see it as a huge discriminator in this context.

COMMISSIONER WEISENMILLER: Yeah, and I don't think we need to spend much time here on that issue, that type of background is certainly in the IEPR if you read it.

MR. TRALLI: Oh, David Tralli, JPL, question.

MR. RUPP: So, my strategy of trying to say the least to get the least questions did not work. Next time. I've got 100 percent more questions than anybody else.

MR. GRAVELY: Go ahead.

MR. RUSS: Yes, hi, Steve. My name is Bob Russ with Internex. We, too, have assisted some MUNIs and stuff in helping them sort of lay things out, and what's interesting is that you do have the leaders, I mean, you have some folks like Alameda Power which is 80 percent renewable already, you know, way ahead of any goal California has, Silicon Valley Power way ahead in those areas, too, in implementing Smart Grid stuff. But what we find, and what I'm just curious if you've had a chance to start structuring your thinking on this, is because in a way the MUNIs, their

owners, are their Board, you know, they're all one and the same, and so they have a lot more flexibility in justifying expenditures. Have you thought at all about how do you help a MUNI really sort of economically justify what it means to try to implement Smart Grid within their system? Thank you.

MR. RUPP: Well, there's – if you want to talk about objective economic justification, these are formulas, and economic justification is a test that, you know, is very straightforward. Where it becomes difficult in this space is understanding the benefits side of the equation because, you know, I would content that benefits are still evolving from Smart Grid implementation. We're still trying to test and understand how we quantify the benefits associated with distributed generation. We're trying to understand how to quantify the benefits associated with demand response. And you know, so it's a little bit of a – I won't call it a guessing game, but it's not a simple analysis that one might do in terms of looking at prioritizing your capital expenditure plan for the year, which is a very mechanical, methodical approach. So, the math is what the math is. I think what you find differently is that a small municipal owned utility is not very well positioned to manage a very significant amount of risk around what a benefit might be. Certainly, the larger more sophisticated municipal utilities, SMUD, for example, a leader in research around

demand response, is very well-positioned to take a little higher risk about quantifying the benefits associated with the demand response because they've been doing research on it for 20 years, so they know very well, and what they make a decision about just to spend a dollar to achieve a $1.20 of benefits on demand response, they feel confident about doing that. I can tell you, other utilities have not done that research and don't understand or see the same benefit from demand response, take the City of Lompoc, a coastal community that doesn't have a needle peak to deal with, demand response to them? Not so easy to quantify.

MR. RUSS: Yeah, I mean, just as a follow-up, like you say, the big guys, the SMUDs and the LADWPs and the IOUs, of course, they can spend lots of money on business cases and very detailed financial analyses, and I don't know the details of your engagement, are you going to try, as part of the assessment process, to try to generate a database or some kind of a master spreadsheet that helps these MUNIs actually evaluate what are the pros and cons for their particular circumstances?

MR. RUPP: We certainly intend – and it's in the middle phase of our project, to – and it's really not – there's not a lot of new science here – what we're talking about doing is taking some of the work that's been done at DOE, some of the work that I know you folks have been

involved in, and we've been involved in developing business cases for, you know, utilities of all shapes and sizes, and coming up with a platform, if you will, through which some decisions can be tested to understand what are the implications. I have to be very careful because there's not enough time or money for us to go through and develop business cases for 29 different utilities, but what we can do is kind of come up with some rules of the game, if you will, that reflect what the industry is doing in terms of managing the risks associated with quantifying benefits that are indeterminate at this point, so that they can hopefully increase their confidence in understanding what to do with the outcome of that analysis. Certainly, it is a part of what we're doing.

MR. GRAVELY: Okay, any other questions? Thank you.

MR. RUPP: Thank you very much.

MR. GRAVELY: Our last speaker of the day here comes from our friends in the Bay Area, and the PUC will talk about the SB 17 and, of course, in the area of two major objectives and policies, SB 17 is one, and AB 2514 on the storage side are two that we've talked about in the last workshop and this one. So I think, actually, Chris is involved in both of those. You can answer questions if you want.

MR. VILLAREAL: Good afternoon. I'm Chris Villareal

with the California Public Utilities Commission. Thanks to Mr. Rupp's presentation, I now have 45 minutes and, as a regulator, I intend to use all 45 minutes now to go over my presentation, this is just the outline of what I anticipate to talk about. I anticipate going through the first half of my presentation relatively quickly because, on the PUC side of the proceeding, we pretty much haven't done any – we haven't issued any decisions since June of this year. And I plan to talk more about what we plan to do in the next year. So this is just a short history of our rulemaking, we started it in December 2008, in response to the Energy Independence Security Act passed by Congress in 2007. SB 17, which was sponsored by Senator Alex Padilla was signed in October 2009, and then that gave us time to issue – to address the discussion in SB 17. So, in response to ISO, we issued a decision in December – all these years are running together now – 2009 – so, ISO directed all State Commissions to consider five new standards to PURPA. In the course of our proceeding, we declined to adopt any of the standards since we had adopted most of the suggestions in our AMI roll-out. Instead, we went a little bit further than what ISO had directed States to do, and we set three policy goals. The first one is that all customers be provided retail and wholesale electricity prices in a uniform manner by 2010, that customers be allowed to access data with an

authorized third party by the end of 2010, and that customers be provided near or real time access to their usage information, those customers of AMI, by the end of 2011. So, while we were doing that, SB 17 was passed, and I'm not going to go through this, this is what characterizes a Smart Grid according to SB 17; what I will note is that the words "cost-effective" are listed six times. So, the Legislature is very direct in what we are supposed to address on Smart Grid. So, SB 17 directed us to set the requirements for the Smart Grid deployment plan to be filed by the utilities, the investor-owned utilities. In our proceeding, we ended up requiring eight topics, and they're listed here, and I'm only going to talk about a couple of these. We directed the utilities to have cost and benefit estimates in their Deployment Plan. Now, for the costs, we gave them two timelines. We directed the utilities to file a five-year provisional cost estimate and a 10-year conceptual cost estimate, understanding that, looking at the future six years ahead, we can't accurate predict what the costs are going to be because we don't know what the technologies are going to look like, or the costs of technologies. Similarly with benefits, we understood that the benefits are going to be not necessarily problematic, but very difficult to quantify. On the benefits, we also allowed the utilities to justify – or not justify – to

describe unquantifiable benefits around reliability and environmental benefits. The other thing we also added was a requirement that the deployment plan address grid and cyber security. The PUC is taking security very seriously and wants to ensure that whatever is rolled out on Smart Grid is secure, and by having it be part of the initial roll-out, that in our mind helps ensure that security is built into the product instead of being added at a later time. So, the utility deployment plans are to be filed no later than July 1, 2011. We also anticipate having a joint workshop with the CEC and the ISO in March or April where the utilities will present their draft deployment plan, and that will be a public workshop, so all parties and all members of the public are invited to attend.

So, this is, I guess you could say, the PUC's vision of the Smart Grid. This morning, you heard the utilities provide their vision and, after we came back from lunch, Mike Gravely pointed out that there was one thing that he thought was missing, and that was a market. I was going to say the same thing, is that the vision presented by the utilities were missing the market aspect of it, and so, from the PUC's perspective, we see a Smart Grid encompassing three main areas, Smart utility, where their infrastructure gets more upgraded and becomes smarter, the Smart customer, who is enabled and is provided with information to take

control of their usage, and the market – so, the market is where a lot of the innovation will take place. The market can be applied to either the utility or the customer, but in both instances, it has to be rolled into the Smart Grid.

So, this is just the short slide showing what are the policy goals of the PUC's view of the Smart Grid. Again, I don't think I really need to go over this, this is following our June decision.

So, where are we going to go now? There are actually five Next Steps that we anticipate taking on over the next 12 months or so. So, Metrics. Metrics is one of the things that is required to be in the utilities' baseline come July 1. In our June decision, the PUC determined that there was not enough of a record to come up with sufficient metrics that would be helpful and informative to the PUC and the parties, so we created a separate phase of our proceeding to do that. PUC staff issued several proposals over the course of a couple months, and we ended up holding workshops and informal webinars to discuss further the attempt to come up with consensus metrics. Over the course of that phase, the utilities, working with staff and other third parties, came up with a list of consensus and non-consensus metrics. The consensus metrics cover areas including customer AMI issues, plug-in electric vehicles, electricity storage and grid operations. What needs to be

further discussed are other areas that we are interested in around customer AMI grid operations, as well as further discussions on how to quantify environmental benefits that can be attributed to Smart Grid, and how to come up with robust cyber security metrics. On cyber security, there was a lot of concern about creating metrics before there are any policies created. And so, we are going to engage with utilities and with interested third parties on an informal basis how to develop good and robust and useful cyber security metrics. I imagine that there will be a similar effort related to environmental discussion, as well. And we expect to issue a proposed decision adopting interim consensus metrics the first quarter of next year.

The next major issue is customer access to information. So, as stated previously, one of the goals of the Commission is to allow customers to choose who they want to share their information with. So, then, we decided that we needed more information, so we set up another phase, an ongoing phase, actually, of our current proceeding to address customer access issues. One of the questions to be addressed is what is the PUC's jurisdiction over third parties such as Google? The next slide will get into a little more detail about that topic. So, as we worked through our process on customer access to information, we got a number of third parties who are all privacy advocates

and I'll admit that privacy was not something we anticipated having to deal with in this phase, and as such, as part of the customer access phase, we added a discussion about privacy. While we were in the midst of doing our phase, the Governor signed SB 1476. SB 1476 puts requirements on the utilities on how they are to protect customer information. So, we held a series of workshops, one of the privacy advocates, the Center for Democracy in Technology, proposed a framework where the utility would not need to get customer approval if the purpose was something secondary to the primary purpose of the usage requirement, so, energy efficiency, for example. Energy efficiency – if a third party is contracting with a utility and the primary responsibility of that contract is through energy efficiency, that third party facility would not need to get customer approval to share that information. If that third party contractor wanted to do something other than energy efficiency, they would then need to get customer approval to use that data. So, in the process, there are three types of third parties that are going to be covered under the privacy rules, one will be the third party obtaining that of the utility backhaul, and this would be the example of Google, where the customer signs up with Google and authorizes Google to access their usage through the utility. The second type of access is where the third party is obtaining

data directly via the Home Area Network, so it was just the Home Area Network was activated and sending a signal directly to the house, and the customer buys a piece of technology, and is just reading the information off of the meter. And the third third-party is the utility contractor that most customers never see because it's just simply a contract between the third party and the utility, and whatever comes out of that process is stamped with the utility's name on it. Of course, there are jurisdictional concerns over our responsibility and enforcement over third parties, and we expect to issue a proposed decision on this topic in the first quarter of next year. On the topic of cyber security, we've differentiated between the different types of cyber security, there is cyber security of customer data and the overall grid cyber security. The security customer data is going to be rolled into the customer access and privacy phase through national standards. On the cyber security, we anticipate building off of the standards, the guidelines issued by the NIST early this year, and we anticipate starting a new phase, another phase of our Smart Grid proceeding to address cyber security rules, policies, protocols, whatever word is most appropriate for that, in the first or second quarter of next year. While we are doing that, the PUC staff anticipates working with the utilities and interested third parties to become more up to

speed on what is going on in cyber security. The reason for that is, the PUC generally has not been involved in cyber security. Most cyber security is done on the transmission level through NERC, and with little information and technology being done on the distribution side, there has been little need to do cyber security rules on the state side. As Smart Grid rolls out, as more technology is installed on the distribution side, and more technology is installed in the customers' homes, that increases the risks of cyber attacks. As states have jurisdiction over the distribution grid, we anticipate creating and building rules around that area.

And finally, we anticipate dealing with the issue around the Home Area Networks. So, when the PUC approved the utilities' AMI investments, they all included the Home Area Network. The Home Area Networks was one of the main drivers of the cost benefit analysis where the customer would use the Home Area Network to do various demand response and price response of taking advantage of prices. The AMI that are rolled out by the utilities that have the HAN on there, but it is not activated. The HAN is loaded with ZigBee Smart Engine Profile 1.0 and the utilities, as we've been told, are waiting for an upgrade to 1.0 to be finalized before they will make an effort to turn on the Home Area Network, thus made a date for 2.0 completion even

though, as stated earlier, it was some time in 2011, that is just for the standard, and that does not take into account the utilities system testing, and it does not take into account the utilities testing of third party products. As such, we don't anticipate the activation of the HAN until 2013 or 2014, at the earliest. So, in our proceeding we've had third party vendors asking the PUC to have a phase to address activating the HAN with the existing 1.0. I'll note that the State of Texas, who is also facing a similar problem, is in the process of activating all of the HANs rolled out in the State of Texas with an updated version of 1.0 that they call 1.X. And 1.X addresses many of the initial concerns about 1.0, around cyber security, and the privacy questions that have been raised on 1.0, as pointed out in the last bullet. In addition to security and privacy, there are some stranded cost concerns about customers potentially buying products that are not backwards compatible, in other words, they buy something compatible with 1.0, but it's not compatible to 2.0, and along with that is the interoperability and upgrading devices. My personal opinion is that, if we're looking at a two-year process, and if California and Texas both end up activating their 1.0/1.X, someone will figure out how to deal with the backward compatibility question. That's my personal opinion, no one else's. And that's all I have, and I look

forward to any questions that anyone may have.

COMMISSIONER WEISENMILLER: Thanks for your participation today, it's really helped. I was sorry that Commissioner Ryan wasn't able to be here, but I think you've done a good job representing your agency.

MR. VILLAREAL: Thank you.

MR. GRAVELY: Questions related to Smart Grid?

MR. VILLAREAL: Well, before I leave, since I have the mic, I'll point out that yesterday the PUC approved a new OIR relating to storage, AB 2514 directs the PUC within some amount of time to set policies around incentivizing storage for the market and we are about a year and a half ahead of the deadline, so we went ahead and opened up an OIR. I believe the deadline for comments on the OIR is January 21st, they're mainly supposed to be focused around a white paper issued by the division that I work in, Policy and Planning Division, so if anyone has any questions on storage, I'll also be more than happy to try to answer them.

COMMISSIONER WEISENMILLER: That's very good. I think Mike can make a similar announcement about responding to that legislation.

MR. GRAVELY: Oh, I'll be glad to. So we have an item on the Business Meeting next week for approval for some research under U.C. where we are developing a vision for storage in parallel with these for 2020 with the ultimate

goal of providing insight and information to your rulemaking, looking at where storage could play with the primary focus of the objective of 2514, but also looking at mixtures of storage and values of storage and things like that, so we are working actively with the PUC and the industry to try – and you've heard through all three presentations the importance of storage to California and the importance of storage and the challenges that storage faces, so we've stepped up there now. I think one side point, also, besides Texas, we are also doing some research on the customer acceptance of Home Area Network displays through UC Berkeley, and Ron Hoffman is here if you have questions about that, but we are doing some evaluations and Chris is actively involved in that, too, but again, it's strictly a research effort to look at the capabilities of SEP 1.0 and the capabilities of existing systems to use that and we're doing a small scale demonstration with several of the utilities in California to help answer some of the questions that are coming up about what is the capability of the systems. So we do see quite a few of those. We will be – some of you may have attended our November 16th workshop on Storage. One of the commitments we made out of that workshop prior workshop in the March-June timeframe was to develop a white paper with kind of an assessment of the state of technology, of storage technology to support

renewable integration and we will be providing that as part of a discussion topic for the next IEPR workshop on storage policy from there. So, questions for the PUC or for Chris?

COMMISSIONER WEISENMILLER: Yeah, I was just going to make the obvious comment, too, that obviously both agencies are moving in response to the Governor-Elect's priorities for Storage, along with the legislation.

MR. GRAVELY: Well, as I anticipated, we are now at a point for public comments, so we will give the opportunity of the people in the room first to comment on any of the discussions we have here today, and please come to the mic if you have comments or questions, identify yourself, and then we'll move forward and if we have any of those, we will go online. Any questions from anybody in the room here for any of the participants or any of the speakers that are here?

MR. JOHNSON: Good afternoon. This is Walt Johnson, I guess I would say I'm representing UCSD with this question. I was struck particularly by the fact that, in the ISO's presentation and the presentations about the IOUs and POUs, no mention whatever was made of microgrids, whereas the JPL presentation from industry had some significant comments regarding microgrids, and I'm curious if that reflects the fact that the other entities, the utility and operation entities, don't see microgrids as

anything unique relative to what they're doing, or how they – where in their road maps those things would fit, if they'd been overlooked or they are in some sense there, but I just didn't see it or hear it.

MR. GRAVELY: In general, I have to say that certainly the IOUs are involved in microgrids because we have both DOE and PIER funded projects right now to do field demonstrations on microgrid. I would tell you, my personal belief is the value of two different perspectives, I think this is one of the examples where I think the commercial perspective sees – it's probably easier and faster for commercial growth through a microgrid than it is to do a utility grid, and so, potentially the reason is, and I'll let David answer that question better than me, but I think one of the reasons from our personal research is the fact that there is a lot of interest and opportunity today in microgrids for new technologies to be demonstrated at a smaller scale and a much more cost-effective scale, so the commercial market is far more attuned to microgrids than they are at trying to convince PG&E to put something on their whole grid. Maybe you want to address that, David?

MR. TRALLI: David Tralli, JPL. I think what you just mentioned, Mike, was one of the key points, that the microgrids afford the ability to go out there and demonstrate things at some scale right now, of course, with

eventual scale up targets. I know with the fuel cell stuff, there is a demonstration project somewhere in Southern California and the interest there is to now move up to a commercial scale 10 megawatt-type system, and so growing it that way. There are some other advantages that came up that we will have documented in the report, but that one, in terms of demonstrating early on what some of the capabilities and issues are to resolve on key technologies is one of the key ones, from a market development perspective.

MR. GRAVELY: I will point out just for the audience, in case you are unaware, that two of the largest microgrids that we're involved with right now, of course, are at University of California at San Diego is doing one on their campus, and the San Diego Gas & Electric has been doing one for many years with the DOE funding and PIER funding, so both of those are what I would say community scale, or larger. So, there is quite a bit of work being done. It may be the fact that the information is at a level that's in the report, but not in the presentation also. Other questions?

MS. CHUANG: We do have microgrids in our report, it appeared on a list of objectives under the subcategory of maintain and/or enhance the system reliability. We had the provide for microgrid operation as objectively considered

for use of Smart Grid. There are also many projects mentioned and, in particular, the Appendix of the report, that the utilities are involved in. Perhaps these utilities want to talk about some of those projects, but it's true, we didn't have microgrids in the top or the high priority, but that was the result of the ranking exercise.

MR. STACK: Hello, this is J.D. Stack with the California Smart Grid Center. And, Mike, I've got a question for you. We've seen several different views today, perspectives on Road Map to Smart Grid. I heard one of the speakers, I think it was David, mentioned this is a suite of road maps. Can you articulate your vision of how these are going to be used going down the road? Is there going to be an assimilation of these, or do you see them kind of in a suite that people can work from?

MR. GRAVELY: The plan when we originally did this was, from the research side, and our schedules were set so that we could do this as part of the 2011 IEPR, and we still hope to do that, is to put together the three of them together and come up with the general consensus and us put together the different data we get plus comments that come from people outside the three contracts, and try to integrate that into a state vision, and I would envision that, if we are fortunate enough, to work it to be part of and published in the IEPR for 2011 in the summer timeframe.

If we're able to, there will be another Smart Grid workshop in the March, April, May timeframe if we're able to get enough from all three vendors to do that. One of the challenges that Pedro has in his office in Systems Integration is to actually learn from all these different efforts, but the original plan has always been to take these three diverse perspectives, see where the parallels are, and see where the differences are, and try to come up with what we consider is a single vision for the State that could then go into the IEPR, and potentially into some of the other State documents as we go forward.

MS. MANZ: I'm Laura Manz and I'm here on behalf of Viridity Energy, who is the vendor doing the UCSD microgrid, and I just wanted to pick up a thread here, that our V Power system works with the pallet and power flow so that we can start bringing markets and economics together, so I don't want to let that kind of fall by the table, it didn't come up so much today, and I think it's probably ripe in the future for further discussion, and we look forward to that opportunity. So, thank you.

MR. GRAVELY: And we'll take that comment you have before about it not coming up today, so I will encourage everyone online and everyone here, the comment period ends January 7th, please provide us your comments, your recommendations of what you liked or didn't like, things

that were missed, technology – and this is a technology assessment, so if you have things that weren't discussed and you'd like our staff to be aware of, please feel free to docket those. We would prefer you send everything to the docket, the information – it's on the message that we have on the Internet and the message here gives you the address of where to send it, but we would like that information available, it allows us to incorporate that information in our overall assessment. It gives us a Litmus test of whether or not, as you hear all these presentations, if we're on the mark or off mark. So, I would encourage people to take the time to provide that feedback officially through the docket, so it becomes part of the 2011 IEPR drafting process, and so we would encourage everyone to do that. David, you had a comment?

MR. TRALLI: Dave Tralli, JPL, I had a comment on the question before last, to clarify my comment on the suite of road maps. I would think that the three different studies, the road maps that they recommend, obviously, like Angela mentioned, are the result of the discussions within the perspectives of their team and the prioritizations that came out of those teams. If we look to integrate all three perspective road maps for the 2011 IEPR, we need to make sure that we have something in common across which to bring those three perspectives. And I'm just trying to iterate

what I mentioned in my talk, which was, if you have the traceability to the IEPR requirements, and if we had that, if we can do that, or represent the three perspectives in that manner, I think that would make the integration somewhat easier to do because, otherwise, you know, you're putting together three perspectives that are responding to three different ways of prioritizing, three different sets of objectives, and that's going to be extremely hard to pull that stuff together. Now, on the suite, I think there is a single maybe road map, or not, I mean, we're still struggling with this, I still am, the road map that gets you to 2020. We're going to look at two or three architectural options because that's the resources we have to do, but in order to pick your preferred road map, we have to optimize across something, and we have to optimize across the trade space, meeting the objectives, technical performance, cost if we can get it, of functionality, ratepayer benefits, all that. And so, we have to offer our view of what that optimization was, and that optimization might be different in the three different perspectives, which is another complexity in integrating the road maps. So, I think that is going to be really exciting, you know, there is a lot of common threads between our study and EPRI's, and I'm sure the POU ones will have common ones there, and then the integration will be really a good thing to do.

MR. GRAVELY: I have to admit, this was a challenge that was consciously created. We talked about this when we did the initial request, and we did not want to provide so much detail as to steer the road map a certain direction, we wanted the policy to be considered, we wanted creative approaches, we wanted diverse solutions, we did not want to – and I think the example I get here is, in fact, the IOUs have provided information that is very consistent with what they're doing and what they've talked about, I think, on the commercial side, as I'd mentioned earlier, I think one of the opportunities, the reason microgrids are mentioned so much, is it provides more commercial demonstration capability and more commercial growth, more commercial transition capability, and I think, when we get to the POU work, when they've got to marry the challenges of small utilities, medium utilities, large utilities, multiple utilities in one agency, and so I was afraid, consciously, when we provided a Government direction, sometimes Government directions can have a negative outcome, and we did not want to stifle creativity, stifle solution, by giving "this is the format you have to fit." So it makes our job a little more challenging to integrate these, but it's easier to have three defined products to integrate than it is to tell three people where to go for a 10-year vision, and not make a mistake. So, we – and Pedro gets to benefit

from that creativity. His office will be the one to help integrate that, and we envision sharing that with the public, but I do think, and just so you know, we consciously anticipated three diverse approaches and it looks like we're getting three diverse approaches, which I think is a good sound. Anybody else with questions? Anybody on line have questions? It appears nobody has questions online.

Okay, so I'll cover the next steps here with everybody. This is a series of two workshops that we have done, primarily the PIER program, one on Storage, one on Smart Grid, we will take the information we have here and come up with information that will be kind of a technology baseline, that we will provide to the IEPR Committee, and whether we end up doing a white paper here, or whether we end up just integrating the road maps into a single road map is yet to be determined, but we are planning on a workshop in about five months, four to five months, that would talk about how this technology rolls into the policy and if there are policy questions and policy recommendations that we can do that as part of the IEPR for 2011, we want to do that in the future. So, I again would like to encourage people online and people here to provide comments to the docket, provide information to us, and if you have questions as to what you would like to see, but the ultimate goal for us is to try and come up with information in the 2011 IEPR to help

understand where Smart Grid is going and where it should go, and if there are specific gaps that need to be addressed, if there are specific policy issues that are creating challenges, or if there are specific areas – I use the analogy of storage – one of the areas that comes up, that you hear a lot, is creating tariffs and creating incentives that will make storage meet the needs of the future. In Smart Grid, it may be more an area of how we work with the PUC, how the public utilities plan their development and paperwork for SB 17 in those areas, but we're trying to integrate everything we've got and to the best knowledge we can. Our ultimate goal through this IEPR process is to share what we're learning and put that in terms of some semblance of direction, but ultimately it'll be up to the IEPR Committee, who hears a lot more of this than I have a chance to, to put this into a perspective of a report. And for those that aren't familiar, the IEPR will be drafted over the summer, the draft comment is available in the fall, it's published around the December timeframe, so we'll be gathering data for the next six to seven months, and then there is a public workshop when they provide all the elements of that. But our office will be focusing on the technology and the Smart Grid.

COMMISSIONER WEISENMILLER: I'd certainly like to thank everyone today for their contributions. I think we've

had a very interesting session. We have three interesting products, certainly those will be the basis for our thinking, but, again, I think one has to be clear on a couple of things. The first is that we are working together with the ISO and the PUC under the framework of the Clean Tech Vision, which we're marching forward on, and so, as we go forward, we will be jointly working through that, certainly PUC will have much more formal proceedings, and this is something for people to throw out ideas, much more of a scoping session, but we certainly anticipate the agencies to be working pretty much hand in glove on this. And second is that we are certainly going to be very focused in this IEPR on implementing the vision of the new Governor and his direction, as we will really have a plan in place by July, dealing with renewable issues for both DG and utility scale. And so there's going to be a lot of focus on the DG component, and it's going to be a pretty serious – I was going to say almost a forced march – between now and that time. And certainly this will be a part of it, but again, ultimately we're the deciders and so, again, thanks for your contributions and we will certainly take your input, but it is certainly the consultants are not going to drive the process is the bottom line. Thanks again.

MR. GRAVELY: Thank you all very much.

[Adjourned at 2:42 P.M.]