INTEGRATED ENERGY POLICY REPORT STAFF WORKSHOP

BEFORE THE

CALIFORNIA ENERGY RESOURCES CONSERVATION

AND DEVELOPMENT COMMISSION

In the Matter of:	)	
	)	Docket No.
Preparation of the 2009 Integrated Energy Policy Report	)	09-IEP-1G
	)	

ORIGINAL

SMART GRID TECHNOLOGIES AND POLICIES NEEDED

TO SUPPORT CALIFORNIA'S ENERGY POLICY GOALS

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THURSDAY, MAY 14, 2009

9:00 A.M.

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COMMISSIONERS PRESENT

Jeffrey Byron

SPEAKERS:

Michael Gravely, Energy Commission

Pedro Gomez, Energy Commission

Erich Gunther, EnerNex Corp

Richard M. Fioravanti, KEMA

Ralph D. Masiello, KEMA

Dr. Emir Macari, CSUS

Richard Schomberg, Electricite de France

Tom Bialek, San Diego Gas & Electric

Paul DeMartini, Southern California Edison

Antonio Alvarez, Pacific Gas & Electric

Michael DeAngelis, Sacramento Municipal Utility District

David McCalpin, GE Appliances

Wanda Reder, S&C Electric

ALSO PRESENT

Rommell Garcia

Merwin Brown, CIEE

David M. Tralli, Jet Propulsion Lab

Fred Fletcher

Stacey Reineccius, Powergetics, Inc.

Dr. Peter Karpoff

ALSO PRESENT:

Patricia Saleh, (Via WebEx)

Mary Kimberlin (Via WebEx)

Dave Hawkins, California ISO

Ron Hoffman

I n d e x

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I N D E X (Cont.)

P R O C E E D I N G S

9:00 A.M.

MR. GRAVELY: Good morning, we're before the California Energy Commission and we'll be starting the session here. Today is the second day of the Smart Grid Workshop.

I'll briefly go through, in a few minutes, a review of yesterday's workshop. But we want to welcome everybody here.

Administratively, again, we have the room here, we also have the WebEx –- I'll get a little closer here -– we have the WebEx going, so we have a considerable amount of people on the WebEx and we do our best to accommodate both.

So at a later date, if you have questions and you want to come up and talk to any of the speakers, we ask that you come and speak at the podium right here so they can be recorded, and that people on the web can hear it.

The whole session today, both the presentations and discussions is being recorded and there will be a transcript, so it will be available on the Integrated Energy Policy Report website, at the Commission. It takes a couple of weeks to do that, but you'll be able to get all the transcripts and all presentations on that website.

And again, just for purposes of safety, if we have some kind of fire alarm or anything, the doors at the side are service doors, we can exit and we can meet out and clear the building. The rest rooms are just out the door, to the left. There is a little coffee shop right around the corner.

They ask that you not bring food and drinks into this room, only water.

And with that, Commissioner Byron, some opening comments?

COMMISSIONER BYRON: I'll be brief, Mr. Gravely. Thank you very much.

I'd like to welcome everyone back again this morning. Yesterday we had a committee workshop on this same subject and I think they'll be going into more detail today, on a number of topics.

Thank you all for being here. I'm here because I'm very interested in this topic and it plays very pivotally into the Integrated Energy Policy Report that we're doing this year.

Commissioner Boyd serves with me on that Committee; however, he's at another IEPR workshop which is taking place at the Energy Commission, on natural gas.

So I would have been fine in the audience, Mr. Gravely, but I appreciate the access to a microphone, thank you.

MR. GRAVELY: Thank you, sir.

So for those that aren't familiar, the Integrated Energy Policy Report is a report the Energy Commission produces every two years. This is a two-year cycle, on the off years we produce an update. Every odd year, I guess, we produce a full report.

So the information from yesterday's workshop and this workshop will be consolidated into a Smart Grid section for that IEPR reporting, including one of the things we're looking for, obviously, is policy recommendation and technology updates. So we take that opportunity to show the state of the industry and we also take the opportunity to identify barriers and recommendations on how policy can help us reach our future policy goals and future goals for the State.

So in light of that I would remind everybody, both online as well as in the room here, in addition to your comments here today, you have the opportunity to submit formal comments to the docket.

Do we have a date for when they're due? I would say two weeks from today is the normal standard time, so I would expect you have at least two weeks. But we would encourage you to submit any comments you desire to the docket, and if they're not already recorded in today's session.

We use those comments and those recommendations as we prepare the draft comments for the IEPR. Those sections will be reviewed by the public, there will be a workshop where the entire section is reviewed, the IEPR is reviewed, so there's an opportunity to see the results of these workshops. And then, ultimately, the results of these workshops will show up in the published 2009 IEPR, with recommendations.

And as we mentioned, there are probably some 60 to 70 workshops during a three- to four-month period, and there are two of them going on right now, one on natural gas, at the Commission and the one here on Smart Grid.

So today's session is a little different than yesterday. Today we're going to have speakers speaking on products, and technologies, and research, so there will be an opportunity with each speaker to ask questions and comments.

We would prefer you let the speaker go through the presentation and finish the presentation, then ask questions.

If there's something that you need clarification for, that's confusing on the presentation, then raise your hand and come down to the mike, and ask a clarifying question, and we'll try and do that. If you're confused, probably more people in the audience are confused.

But if you have specific comments or other comments, wait until the end. So we're hoping to have about five or ten minutes after each speaker for comments and questions.

At the end of the day most of the speakers will still be here, there's a session to ask questions of all speakers.

So the morning's agenda, we have a little -– we haven't got the agenda on the slide, we'll have it for a little bit later.

But the first session, today, I'm going to give you just a five-minute recap of yesterday's workshop, and then we're going to go into some of the research that's being funded by the Energy Commission.

Pedro Gomez, who is our team leader for Energy Systems Integration, and who manages all the Smart Grid research, will give an update of what all his office is involved with. And, in many cases, he'll give kind of a lead in to some of the more detailed presentations for the day.

And for example, we mentioned several white papers that were in process, yesterday. Today you will hear the status of those and have a chance to ask questions about those, have some input to those.

And then our plan is to have those drafted and published in the July time frame, and posted on the IEPR website.

So those of you that are interested in the actual white paper or we may be calling it a staff report, it will be published publicly on the website, certainly before the draft IEPR report is approved.

So yesterday we had a combination of three panelists. We were really fortunate to have Commissioner Byron, Commissioner Rosenfeld, Commissioner Chong, Kellie Smith, from the Legislature Staff of the Energy Committee, for the Senate, and Jim Detmers from the ISO on the first panel.

It is a great –- it will be recorded and it was a great discussion. We had comments, an hour-and-a-half discussion on California policy.

And the ultimate question we asked is how is the Smart Grid going to help California meet the policy?

At the end we discussed some areas that are of the most interest to people, renewables, and making renewables more accessible in California was one of those. Implementing energy efficiency was another of those.

And also, in the area of demand response we talked a quite a bit about different opportunities. And Jim Detmers had mentioned, for example, he needs, in these areas like efficiency and demand response, he needs to be able to use them as a resource, and we need to be able to quantify them and we need to be able to plan for them.

So he wants to have some help in being able to turn demand response into a generation resource, just like a power plant or a renewable is.

We also talked about the need for storage and the value storage will play, and some of the challenges we have for storage. We had a separate storage workshop we had that addressed a lot of those, but it came up again yesterday as one of the solutions that they think helps in the area of integrating renewables and making the grid more accessible in the future.

And then also Commissioner Chong, particularly, was talking about plug-in hybrid vehicles and how the acceleration of those plug-in hybrid vehicles has become an issue that we need to discuss.

The American Recovery and Reinvestment Act is putting a substantial amount of money in that technology, so we envision that technology making a big leap over the next few years.

As a matter of fact, we discussed during the day the Smart Grid element of that investment, which is $4.5 billion. There's another $6.5 billion going to BPA and WAPA, so a total of $11 billion that's dedicated to grid improvements, enhancements and development.

So that amount of money, in a matter of a few years, has the potential of giving us the growth in two, or three or four years that we might have expected in a decade or longer.

So that also adds some of the challenge when it comes to interoperability and those types of questions.

One of the other challenges, of course, was for us, from the utilities and manufacturers that were here, that we should develop a Smart Grid that is interoperable and that we not come up with a bunch of pockets that work well together, but don’t communicate interoperably.

So one of the challenges, and you’ll hear today, some standards work, is an area of how to make that work effectively.

We then had a panel with the utilities and the utilities were asked several questions, primarily about how policy can impact the growth of Smart Grid, where are we on the status of Smart Grid, and how can policy and how can the Commission help?

In general, they all were consistent in one review, and I think that is I think there’s a perception that California is a leader in the country in Smart Grid development and Smart Grid demonstrations, and that we need to continue that development, and continue that role, and not waiver and continue to be the Smart Grid State, as some people refer to us as, and actually implement many of these projects that we have.

And you’ll hear today lots of small projects. The key, yesterday, was to integrate those into bigger projects.

It was also mentioned that in several states there are Smart Grid –- they call them theme parks or demonstration sites.

And Commissioner Chong was hoping that as part of the Investment -– the Reinvestment Act, that we will have a large facility, somewhere in the State, that we can call our Smart Grid city, or Smart Grid community, or Smart Grid demonstration site and it has all the elements in one.

And we’re hoping that some of those demonstrations that are coming, on the competitive side, those opportunities will come. That will allow us to work some of these interoperabilities.

We did have a panel that was the investor-owned utilities, two public utilities and an industrial utility, so we had a very good mixture.

I was going to ask the question, unfortunately I didn’t get to it, and that was how do we get that mixture of utilities to do one Smart Grid demonstration? That would be a great project when it comes to interoperability. So that’s your challenge for the future.

And the other thing that they identify, I think, in the area is that the utilities in California see the need, we have an insertion of money for Smart Grid demonstrations, but there’s a 50 percent match.

And so the utilities have identified the need to be able to have that match, to do those projects, and that we not just do everything based on one site, that we have some opportunity in the future, and with the Commissioners, and the PUC, and the public agencies that manage the public utilities be aware that we’re at a point, now, where demonstrations have a lot of value. But they’re expensive, they’re 10, 20, 30 million dollars, they’re not a hundred thousand, two hundred thousand. And so they are substantial amounts of money and so they do require pre-approval to be able to plan it.

And so I think across the board, in the utility area, there was a recognizing the fact that we’ve reached a point where some pilot projects, that are of substantial size, can make a big difference in that growth of the next generation of Smart Grid.

The final panel for the day was our industrial/manufacturing group, and we had a very fortunate mixture of individuals from throughout the industry. And we actually showed some technologies that were developed where we, the industry is already working with, for example, a thermostat that can communicate with wireless, with one-way communication, with different types by simply doing the plug-in module. Similar with a battery, you just plug it into the back of the device.

So the thermostat never changes, the communication does. The software to make that work is already available. So whether you use WiMAX, or Zigbee, or Home Plug, all those have a little box, you plug it in and it works.

And so those are demonstrating the industry's innovation in making demand response and Smart Grid technologies work in the future.

They are interested and concerned about standards and codes so that they don't develop products that as soon as they're developed they're obsolete; even though they're pretty open in the way they're doing that.

They also mentioned across the board, on the industry side, they also thought California was a leader in the Smart Grid area and they recommended that California continue to pursue that leadership and help to do that, so we anticipate that happening.

So again, the overall industry perspective was that industry is very interested in doing things. They want to consider, as we go forward, the policies, and processes, and standards and protocols to be sure that they're open and they allow competition, and that we don't inadvertently go down a road where we have a proprietary solution and we're locked into a solution where it locks out lots of competition.

We have to make certain decisions, but we want to make those decisions where there are open architectures and allow as many people to compete as possible as we go forward. And again, you'll hear more about that today, as we go forward.

And so that wrapped up the process. And again, it was a very successful overview from different perspectives.

And so today, if there are any questions, I'll answer questions real quick before we go into the presentations. Questions from anybody?

Okay, I do have a card here from a Rommell Garcia (phonetic). Is he here in the room? Okay, we'll delay that until later.

So anyway, the first speaker for today will be Pedro Gomez, from the Energy Commission.

Many of you have heard me speak for a long time on the stuff that we're doing at the Commission. Fortunately, all the stuff I talk about, that's grid related, Pedro manages, his team manages, and he's responsible for the actual execution of it.

So he'll talk with you today about the different projects that he's managing and the future view of where he sees things going. Pedro.

MR. GOMEZ: Thank you, Mike. I'd like to start off by -– first of all, let me ask a question, I need to do the page 2 on this?

MR. GRAVELY: Yeah, just hit down.

MR. GOMEZ: Okay, so I'd like to start off by thanking Mike Gravely for allowing me to share with you the research activities that my team is involved in, involved with related to Smart Grid.

We are funded by the Public Interest Energy Research Program, PIER. PIER funds research in seven functional areas. As you can see, one is buildings, industrial ag and water, renewables, environmentally preferred advanced generation, transportation, environmental and energy systems integration.

I am the team lead for ESI and our focus is in research related to transmission, distribution, demand response, DER integration, grid security, energy storage, grid infrastructure integration, intelligent agent integration and application, advanced communications and control.

Our goal is to facilitate the development and integration of hardware and software technologies that support -– I'm sorry -- to facilitate the development and the integration of hardware and software technologies that support California's energy policies and lead us to a Smart

Grid.

How we do it. We identify electric system limitations, we confirm those limitations through stakeholder forums, we fund public interest research projects to overcome those limitations and improve the electric system. We focus on integration of new technologies for Smart Grid and we aim to provide ratepayer benefits and support California’s energy policies.

However, our average annual budget is $10 million, give or take a couple million. We are actively and currently managing $136 million in projects. We try to leverage our funding to maximize opportunities with other stakeholders, such as universities, utilities, other government agencies, and the like.

Our research focus is in –- I’m getting ahead of myself here.

MR. GRAVELY: Pedro, can you move the mike a little closer?

MR. GOMEZ: A little closer.

MR. GRAVELY: Thank you.

MR. GOMEZ: You’re welcome.

So what we’re focused on, on doing research with grid infrastructure, and we’re trying to also look at how the communication system affects the grid and meshing those two technologies together, so that we can begin to implement and deploy storage onto the electric system, plug-in hybrids, solar panels, tanks, and other forms of renewable generation.

One of the projects that we're currently funding --

MR. GRAVELY: You hit it twice there.

MR. GOMEZ: Yeah, I did see that.

One of the projects that we're currently funding is looking at the data that is being collected by phasor measurement units that are disbursed throughout the transmission system in the western states. And that data, we believe, that we're currently working on analyzing, we believe tells stories that could lead to system operators being able to better manage and better control power outages and shifting loads, when necessary.

I'm going to kind of relax a little bit on this. You know, the first time I saw this picture it kind of brought a smile to my face because it reminded me of the drawings that my daughter, when she was two, would bring home from school. And I kind of laughed about it until I actually started paying attention to what was being said here and I realized at that point the challenges that we're facing integrating renewables, such as wind generation.

With that said, we looked at -- so looking at this diagram, at this slide, we see that wind generation is not predictable. There's an issue with when and how we collect that power.

We believe that storage is the solution for being able to integrate renewable generation onto the grid. We have projects in battery technology, such as zinc bromide, sodium sulfur, lead acid, lithium ion.

We're also involved in projects for compressed air, pumped hydro flywheels, and we're looking to get more involved in residential size storage projects.

Okay, this slide, what I'm trying to explain here is that the grid of the future must have two-way power flow. We must be able to have the ability to do what we're doing now, which is pull power from the grid, and we need to be able to put power back onto the grid with renewables installed.

Additionally, we believe that two-way communication is absolutely the second component to the Smart Grid, that we are funding projects to enable this.

Okay. Besides renewable generation, we see demand response as a great way of controlling load, empowering consumers, and reducing the need for the deployment of new power generation facilities.

We are funding projects that support demand response automation for all customer classes, at the residential, commercial and industrial level.

We believe automated demand response allows consumers across the spectrum to increase efficiency, lower cost, and reduce the carbon footprint.

With demand response we can shift the power load and avoid using inefficient, costly generation.

One of the others that we’re funding is the Enabling Technology Development Research program. And in this project we see -- the picture that you see on the screen is a sensor device that in 2003, I know the image isn’t so well, but the sensor, in 2003, appeared to take about a quarter of the room.

Today, they have developed sensors the size of a sugar cube and they continue to work on reducing the size of those sensors.

What can we do with those sensors? We can utilize them and put them throughout the home, throughout a business. You can integrate them in appliances. We can integrate them with the air conditioning systems, so that if you walk in -- if you’re in your home, and you’re not in a room, you know, you have a three-bedroom home for instance, and one of those rooms is not occupied, the system will sense no one’s in that room, it will close the vent in that room and allow you savings.

Further, this project is looking at the -- is testing what power levels and what frequencies these sensors need to operate in, in order to maximize their ability.

Okay, with that said, I'll share with you some of the activities that we have coming forward. First of all, we've recently advertised an RFP, Defining the Pathway to the California Smart Grid of 2020.

One of the contract -- one of the contracts will be awarded to a utility perspective awardee. The second will be awarded to an industry perspective awardee.

Each one of these projects will be funded for approximately $500,000.

In addition to that we have -- we're involved with some of the folks that you're going to hear from a little later, a white paper on how Smart Grid technologies will make electricity energy storage more useful in meeting California's goals; Micro-Grid demonstrations of Smart Grid technologies.

In addition, a white paper on defining Smart Grid standards, codes and protocols, a white paper on the Smart Grid technologies that will accelerate the fielding or increase the penetration of renewables in California.

With that said, this concludes my presentation. If you have any questions, I'd be more than happy to try to answer them. And if I can't, I've got a team in the audience that will help me.

Thank you.

MR. GRAVELY: Okay. Thank you, Pedro.

So also, if you have questions that come up, you can use a blue card if you want. But also, in this case, we're a little more informal, so just feel free to raise your hand or walk up to the mike. We don't have a roving mike, so I need you to walk up to the mike if you want to have questions, I know they go fast.

And if something comes up, the panel members at the end, we'll have a chance for all the panel members to answer questions before we take a break.

So the next few presentations are actually going to be on the white papers we talked about earlier and giving you an interim status of what's going on, and give you some insight on what we anticipate the white paper talking about.

Many of you may know that the Department of Energy just recently awarded a contract to EPRI, and one of the subcontracts, in addition to helping us, Erich Gunther is a subcontractor on that workshop, on that task, and that is to come up with a first cut on the roadmap for standards for Smart Grid in the nation.

And so we are very closely tied in California with what's happening nationally in the standards process, which is what we want to do.

And so today Erich will talk with you about where we are in that process, some of the priorities for

California, and also how they compare to the priorities for the nation. Erich.

MR. GUNTHER: Thank you, Mike. All right, you know, what I want to do here today is talk about the standards technologies, protocols that seem to be applicable for application in California to accelerate the Smart Grid.

First, as a context setter, many of you are now becoming familiar with these seven characteristics of the modern grid, developed by the Department of Energy and the Modern Grid Initiative, but I like to show them to sort of keep things in context as to what we’re trying to do.

These standards and technologies are not there to be deployed because they’re interesting, or cool, or technology for technology’s sake, they’re there to allow us to facilitate the implementation of various applications that let us address what we’re considering these key characteristics of the modern grid.

We think these seven areas are consistent with the policy goals that we’ve heard articulated by the Commission and CPUC, so we’re talking here about the enabling active participation by consumers in the overall energy supply chain; accommodating all generation and storage options, so allowing us to implement renewable and other forms of distributed generation; enabling new product services and markets to support competition and market pressures to reduce cost; providing power quality for the needs of a digital economy; improving the grid, itself, from an asset utilization point of view and operating efficiency; further improving our existing capability to operate the grid in a self-healing manner to improve overall reliability; and, further, to operate resiliency in a variety of situations, man-made and natural disasters, physical or cyber attack.

So those are sort of some of the core driving elements.

What we've been doing for this white paper is trying to survey the existing standards and technologies landscape, identify those elements that are available for application now, identifying gaps, things we need to fill.

And as Mike just mentioned a moment ago, this happens to have a very high degree of consistency with the work that's going on in the NIST Accelerated Roadmap effort, so I'll touch on that here, near the end.

So we're very focused on standards. So, you know, what's the big deal about standards? I mean, any competent engineer can glue any two systems together and find a way to make it work. But doing that is not very practical from a long-term point of view. Even though you can do that, it's difficult to maintain, secure and manage those kinds of systems.

We've been doing that in the power industry for a long time and standards-based implementations are a far more effective way of implementing systems of systems as complex as what we need to do for the Smart Grid.

So we use standards to avoid reinventing the wheel, to learn from industry best practices, to be able to specify requirements more easily and clearly, reduce integration costs, to prevent the single-vendor lock-in problem, to allow markets to thrive, to lower the cost of the technology, and to allow vendors to share a much larger market. So all historical reasons for, you know, using standards in many industries and that applies, you know, here as well.

Why can’t we just pick the standard for Smart Grid? Why can’t we just pick one thing? That’s something that I get asked a lot.

Well, I mean, there’s a lot of differences between the Smart Grid and, let’s say, just the internet. From a physical point of view, we have a situation where the network must be absolutely reliable, it must be deterministic, we need to depend on it. If we’re, you know, looking to improve the reliability of the system, which already has several nines of reliability, we can’t be using technologies that fundamentally don’t have that same level of reliability, they have to be better.

Also, the end points that we’re dealing with, with most Smart Grid elements, have to be much lower cost than we can typically get away with on your PC, or other technologies. The device hardware's in the field, it's put in, it's expected to last for, you know, 10, 20, or more years, so it's much more difficult to upgrade.

So a number of elements that make it a little bit more difficult for us to just pick one thing and get it implemented.

You know, we have very differing needs in the system. We can't just ignore rural customers and expect to have a high bandwidth pipe going to them that we could run a common protocol on.

Security is much more important, we need it all the time and, again, in a very deterministic manner.

And there's a lot of work still going on in the application area, and the applications are very diverse across the Smart Grid space.

So there's a lot of issues that we have to be able to address in the Smart Grid landscape.

The other thing that we have been finding, as we do this research, is that there's a wide range of understanding in most people's minds of what they mean when they talk about a standard.

We're working on a separate white paper to talk about, to provide a primer on what standards are. But some of the elements here to recognize are there are several levels of standards, if you will.

You know, at the highest level, before you start producing a standard, you're starting off with a value definition, a high-level description of the problem area that you're trying to solve, the overall economic justification.

Once you get beyond that, you can start writing documents that provide specifications for what you're trying to do, concept of operations, use cases, operational scenarios and then, eventually, defining some requirements. So they're not necessarily a standard that someone can go and implement, but they are a standardized set of requirements that everyone should follow.

Moving a little farther along the standards continuum you start getting into some platform agnostic standards and specifications, the definitions of how an application should interoperate; the definitions of how specific communication standards or the communication layer; specifications of information modeling; data standards.

And then further, as you get closer to the actual hardware, you start getting into specific equipment standards, specific standards for platform communications, for specific technologies and the like.

The other thing to recognize, that none of these are all that great in the long term if there’s not a framework, a governance framework for being able to certify that compliance is being achieved in these various standards area.

So the standards landscape, you know, is wide varied from just simple specifications put together by users groups and consortia, all the way through very detailed, technical specifications put together by formal standards development organizations.

In order to -- there’s been a lot of talk, both within the Federal government, and the NIST activities, as well as in California, what can we do to accelerate the adoption of Smart Grid?

You know, and there’s some challenges for doing that. There’s a lot of things we can do to accelerate and move faster than the industry has typically done, but there are some challenges and things that we need to make sure that we address, so we’ve discovered these as we’ve been working on this white paper.

First of all, the number of stakeholders, and the range of considerations, and the applicable standards, you know, cover -- are very large and complex, they cover a wide range.

And given that, a formal governance structure, at a national level, is really necessary to come up with these formal processes to prioritize and oversee the high-value tasks, to help coordinate the multitude of standards organizations that are out there, avoid duplication, promote coordination and try to find some means for ensuring that all the voices are heard, you know, to provide these recommendations for which things we should apply and when.

The other thing to realize is Smart Grid implementation has already started. Depending on your definition, we could argue that we've been deploying elements of Smart Grid, for example, an advanced system protection, for a very, very long time.

But in recent times, with advanced metering infrastructure and some of the leading utilities that are working in California here, there's a lot of work going on and they've recognized that this is an evolution of projects over time.

So standards adoption has to consider the current state of deployment and development that's already in progress, the installed base of technology that's out there, and take into consideration the real live, life vendor product development cycles.

You know, once you specify a standard and for a vendor to implement that, if their platform fundamentally was not designed to support that, you're talking 18-month product cycles. So you've got to be aware of some of the realities of those elements.

Also, interoperability needs to be scoped. We need to define where in the Smart Grid landscape interoperability is important.

You know, if you take a cell phone and work on it, and take a look at what's inside, there's probably hundreds, if not thousands of standards inside the box that may be applied, and every vendor will use a different mix of those.

The standardization of which ones of those inside that cell phone aren't anywhere near as important as the standardization of the protocol externally to that, the external well-defined points of interoperability, what we would call the inter-system standards.

The same thing with Smart Grid, we need to identify the core zones or domains of interoperability, where we can capture the most value.

So what do we need then in Smart Grid? So for the applications of interest, and that's the key thing, deciding what the applications of interest are in a particular area, for all of California, a particular service territory, hopefully, we can agree on a few core things.

You know, what is the information that needs to be exchanged; how do we name the data so that we know what we're talking about; who are the entities that are allowed to communicate this information, who has access to it;

what's the formats of the messages to be transmitted?

If we get low enough of a level and it's necessary for interoperability, we may need to talk about frequencies and signaling.

And in the worst case scenario we got to get very specific, maybe we got to talk about what the connector looks like, you know, like the U-SNAP interface for PCTs, for example.

So the answers are different depending on the physical area of the grid that we're operating in. Sometimes they're different in the region, even within California. You know, different functions to be performed have different requirements, so we have to realize that.

Just to help sort of describe -- where was that -- well, artifact came from there.

But in order to, you know, take a look at this, just trying to break down the Smart Grid domain into a few several areas. And right now, within the NIST project team, we're trying to come up with a standardized set of domains and interfaces.

So we haven't harmonized all these things yet, but they roughly follow this kind of a breakdown.

You know, we've got, starting with the load, you know, basically the area, the zone of the system where most of our loads reside, the consumer side for the most part.

We’ve got the distribution system elements, we’ve got the transmission system components; the back office within the utility, and energy service providers and others.

And then externally we have the market and regulatory functions.

Those map reasonably well with key Smart Grid interfaces, the extranet, the enterprise, or enterprise service bus, for example, the wide area network from a communications point of view, the field area network.

If we can insert in here the substation, we’ve got the substation area network, and then the home or premise area network.

So we can start to identify some of these core zones of interoperability.

We’ve analyzed that for the purpose of this white paper, you know, in terms of Smart Grid standards domains, broken it down a little bit further. And in our initial analysis, we’ve identified some of the key standards that already exist or are in evolution in these various areas; at the enterprise, the control center, the wide area network, the field area network area, consumer, et cetera.

So the interesting thing is that there are a lot of standards and technologies available that we can start using today. There are also plenty of holes and there’s lots of room for improvement, but there are opportunities to apply standards and obtain the benefit of them sooner than later.

I’m going to summarize just a very few of them, with some of our core recommendations that we’ve put together to date. We’re still working to finalize this and getting feedback from a number of folks, so these are by no means final, but here’s what we’re starting to see.

On that external side, the market regulatory, external interface point of view, there’s already a plethora of standards used for e-business. Most of these are web or web-services based.

Most of them are not really tailored for electricity markets, but can be adapted to do so.

You know, there’s mechanisms for passing events through to consumers, through this kind of a mechanism, so a market event or whatever you can pass through, you know, to consumers using these technologies.

But there’s a variety of elements that need to be done to agree on procedures and process from the market point of view, and how that we should use those technologies to pass things like pricing, and the like on to the end consumer.

So one of the things that comes up over and over again is we enable technology, we identify Smart Grid technologies to empower the customer, focusing on that first modern grid characteristic.

The thing that comes up over and over again, and this was a major point that was made at the NIST workshops a few weeks ago, was that implementing rates that in one way reflect the true or closer to the true cost of energy to provide an incentive to manage usage is a key regulatory recommendation that's necessary.

And we can have all the technology in the world to empower a consumer to receive pricing information and automate systems to take advantage of it, but if we don't have the rate structures in place to provide that incentive, you know, the technology doesn't do us a whole lot of good.

There are several technologies under -- in development here that can be helpful. Continuing the development of the open ADR work for demand response information exchange, for commercial/industrial is important.

Investigate the ebXML standards for business-to-business use and see if that is applicable.

And standardizing interfaces to third parties. You know, this has become very important here recently, with the activities that Google has been doing, working on some of their applications that they've been working on has shown a clear need for an automatic data exchange, what we're calling ADE, in the UCA Open Smart Grid group. So trying to identify and standardize interfaces for historical billing and usage data, as well as real-time data is a key element here.

Moving to the utility and corporate control center, there’s many different systems, large amounts of data at high speeds, very labor-intensive process to set these up. There are lots of good interfaces and technologies to apply those available.

But agreeing on the application language, again, the common language will reduce the cost of those implementations.

Luckily, much of the utility industry is already moving towards using the common information model, an IEC standard. Most are already using inter-control center protocol and there’s work going on in the rural electric community with multi-speak as an alternative information model, and work’s going on and needs to continue to harmonize those. So those are some of our recommendations at that level.

Moving into the transmission area and the wide-area network area, there’s lots of wide-area technology networks available. One of the core principles that we’ve been identifying in Smart Grid is we need to find a way to be as agnostic of the lowest low-level communication technology and implementation methods as possible, because we can guarantee that that will change very quickly.

A system that’s not independent of that, you know, will quickly result in stranded assets and that’s a problem.

But, luckily, there’s plenty that we can use and we can architect these systems in a way to provide that level of independence.

There are commercial off-the-shelf solutions for network management and security of the wide-area networks, so those should be used.

And there’s utilities and protocols -- utility protocols to substations or within the substations are already fairly mature.

Things like IEC 61850, using those in new substations and for wide-area protection schemes is recommended. But the DNP3 protocol and technology for legacy, interfacing with legacy subs, you know, is also a viable way to continue moving forward.

Moving into the utility distribution arena, this is where things start to get a little bit more complicated in the field area network.

In the field area network, both for AMI, as well as for distribution automation and other asset management, and other field applications, there’s a variety of proprietary solutions that are available.

And like the cell phone being, you know, having a variety of proprietary technologies inside that box, but having well-defined points of interoperability to the outside world, like a standard keypad, a standard technology protocol to talk externally, that can be okay as long as those well-defined points of interoperability are standards based so you can support the vendor competition and ability to match an appropriate technology to the problem at hand.

There are standards that exist in this arena but they're widely varied in their suitability, a lot of people looking to play in this field area network space.

There's an issue with solving cost, range, speed, reliability puzzle, there's a lot of tradeoffs in this area.

And because of all these things, it's difficult to deploy internet protocols. You know, you hear people talk about over and over again, well, just use internet, just use internet protocol.

Well, because of the issues I talked about earlier, you know, you really need to tailor your selection of specific protocols to the specific system requirements at hand, so that needs to be analyzed.

So in general our recommendations, you know, use internet protocols where applicable and practical, use DNP3 in the field area network until the 61850 standard is a little bit more pervasive in that arena.

There's I-triple E standards that are available for power quality information exchange, phasor measurement, and the like.

We’re encouraging innovation in the radio technology to get some more standardization there.

But one of the key elements, and I’ll summarize later, is the need for developing dynamic system protection configuration methods to support pervasive deployment of distribution automation, distributed generation, demand response, and especially for plug-in electric vehicles.

A lot of folks don’t really yet recognize the huge impact the pervasive deployment of those technologies will have on the distribution system, and that is going to require the development of new planning tools, so there’s a lot of work that has to be done in this area.

The local home area network side, lots of standards, matter of fact too many standards to be interoperable in the building or home-automation arena.

One way is to try to select some proven leaders, at least for the primary point of interoperability to the building.

You can argue that we really don’t care what happens within the home or within the building, at least to some extent, as long as we’ve got that well-defined point of interoperability with a common information model that can be translated to those multitude of protocols inside.

But there’s a quite a bit of work that needs to be done there to develop that common model.

So that's our recommendation, develop the common information models based on the IEC SIM, use the ANSI metering standards, you know, apply the AMI SEC, UTILI-SEC, Open HAD security specifications.

And on the PEV side, try to do a better job coordinating with the Society of Automotive Engineers on PEV integration standards.

One of the things we've been discovering is that some of those technologies and expectations that the SAE is looking at, they seem to be, I'll exaggerate a little bit here, but ignoring safety standards, the National Electrical Code, MFPA 70 and others, so there's some issues there.

On the consumer side, you know, using the Zigbee Home Plug Smart Energy profile for the homes is a current best practice and recommendation.

It's especially helpful now that the leading wireless provider, leading wired or power line carrier provider are now working together on a common technology independent, or physical layer independent information model, so that's very good news and, hence, that recommendation.

On the building side, using the BACNet and Open ADR, assuming that Open ADR moves along and is successful in its standardization for industrial and commercial communications.

Use or create new protocol variance. A lot of folks don't realize that many of these standards, things like DNP3, things like BACNet are already using and can be transported over, using internet protocol.

So where it makes sense, where the benefits are there, that's a good thing to try and do.

And the activity, I think you may have heard of this yesterday, but support de facto industry efforts, like U-SNAP, in order to allow the end-devices in the home to deal with those multitude of networks that we're probably not going to get rid of for a while and at least make it easy to achieve interoperability from that point of view.

Now, what I wanted to do -- that's just a very real quick whirlwind tour through some of our observations that are in the white paper.

One of the things that's been going on parallel, as I mentioned, is this NIST roadmap, the National Institute of Standards and Technology roadmap effort. And they published last week a -- and you'll see the LHF appear all over the place, for low-hanging fruit. They published the low-hanging fruit standards list, which has a very high degree of correlation with the work that we had already started to do here for Mike, in California.

And in fact they started with a lot of that work and expanded upon it in the first workshop.

So in this list, I'm not going to go through these, but you will see many of the ones, the standards I just mentioned are -- almost all of them are on the NIST list, and so we're going to try to continue and keep that harmonized as much as we can.

Okay. Some major challenges, just to point out, some key things, the pervasive deployment of variable generation, so wind and solar, really requires us to use Smart Grid technologies in order to enable that pervasive deployment.

We need to be able to manage that variability, we need to be able to manage -- even with storage, we need to be able to manage the storage.

Or even without storage, we need to be able to manage demand response fast enough to be able to act as the spinning reserve in many cases.

And as that penetration goes up, you know, it becomes more and more important that we employ these Smart Grid capabilities, coupled with communications and information exchange to empower it.

Similarly, pervasive deployment of distribution-connected DG, distributed generation, and plug-in electric vehicles fundamentally affects distribution planning, upgrades that are required of the network and the operation of the network, as well as system protection. They're dramatically affected by pervasive deployment of these elements.

If we had just a few here and there we can -- you know, we can manage it. But as we get high penetrations, it starts becoming a much more challenging problem.

Similarly, with pervasive deployment of demand response, another project that we're working on within the CEC here and with the PIER program is looking at the impact of pervasive demand response on system stability, interaction with automatic generation control and the like. And so there's some significant concerns there.

So bottom line is, you know, new standards, technologies and best practices are required to address all these, as they become much more pervasive in their deployment and get beyond the science project stage.

Another thing to recognize is that standards development as a major life cycle to it. You know, we've got the needs development, we've got the platform agnostic standards I mentioned earlier, then technology-specific standards, but there's a lot of iteration that has to occur with the certification and compliance side of things, and there's very little yet going on, you know, on that standards enforcement track, so there's a lot of work that has to occur -- occur there.

There’s very few of these standards that have any kind of governance necessary to deal with the enforcement issue, if you will, so that’s something we have to deal with.

So in conclusion, many of the standards we need are already there. There are different needs and different environments; one size does not fit all. There’s a -- we need to define the new applications, and procedures, and processes that will -- that standards need to be applied to support.

There’s a need for agreeing on common information models across the entire system. Where appropriate, we can create and define new protocols. New technologies do need to be developed.

But a key thing is we have to apply systems engineering discipline in order to identify specific requirements, in a specific part of the grid, and make the appropriate mapping to technologies that can implement the business case.

Each of these tasks, each of these elements has a cost associated with it. Standards provide the most benefit when they’re implemented frequently and pervasively.

If you have niche areas of the grid, you know, generally, standards are maybe not the best thing to do. But understanding the interfaces is still very important.

Cost-benefit analysis needs to be done. One of the biggest issues that came up at the NIST meetings a couple of weeks ago was noting that a standardized approach to cost-benefit analysis, especially for the societal benefits, environmental benefits, is really key to getting some agreement on how -- you know, how we value these things and can make these decisions about when to deploy them.

You know, a major question here is which are the easiest to justify, so this low-hanging fruit effort, again, going on at NIST.

And my final point here is that we think it's important that we maintain synchronism with the NIST roadmap. We want to -- don't want to just do what is -- the NIST roadmap does, we want to make sure that we can apply these technologies as they are needed in California, to address California's specific issues, but doing so in synchronism, at least at some level with the NIST work, we think is an important goal.

MR. GRAVELY: Okay, any questions here from the audience, and we'll open up the WebEx.

Come on up and speak into the mike, if you will, that way they'll hear you back there.

So go ahead, if you have questions go ahead and line up and we'll have a question and answer session, and then when we're done here, we'll open it up for the WebEx.

MR. BROWN: Okay, Merwin Brown, with the California Institute of Energy and Environment.

Erich, your talk and most of the literature nowadays talks about developing national standards. I hear very little about international standard development. Is it because it's not important, it's not easy to do, or it's just being done and we don't hear about it?

MR. GUNTHER: Almost every one of the standards I mentioned are international standards. A large percentage of them are standards from the IEC, the International Electrotechnical Commission. So most of them -- so I participate in these standards, so I almost take it for granted that they're international and I thank you for asking -- for mentioning that.

Almost all of these standards are international in scope. The I-triple E standards are international in scope.

Some of the user group-related ones, the industry standards are also national -- or international in scope.

There are a few that are like ANSI standards, so ANSI c12, more North American focused, still can be used internationally, but tend to be -- you know, that particular family is national.

MR. GRAVELY: Go ahead, unmute the WebEx and we'll see if that works. We may have to do a type-in. But see if the -- we have a question here, first, and then we'll go to the people online.

MR. TRALLI: Okay, Erich, nice piece of work, I look forward to the white paper.

You mentioned a physical enterprise level and applications domain, and so I'll offer -- the question really is what is a Smart Grid architecture and how is that different from the current?

So I'll offer that a best, or preferred, or optimal Smart Grid architecture is one that meets the top level, say, policy type requirements and also addresses the requirements that come from the bottom, from the vendor/manufacturer end, and user community.

MR. GUNTHER: Uh-hum.

MR. TRALLI: So my question to you is what is or how do you see the relationship between standards development and exploration of system architectural tradeoffs? Are these things that play together or is there going to be a natural tension between standards development and system architecture exploration for the Smart Grid?

MR. GUNTHER: In many cases, in the past, standards have been developed in the power industry based on a technology-driven point of view. You know, someone thought of a very narrow approach to solve one piece of a problem and worked to identify a standard to address that.

What we've been working on over the past several years, starting with the EPRI Intelligrid work and the like is to take a much more systems view, a system of systems view, in which we do start to produce at least a conceptual architecture, maybe even get down to a logical or component architecture to start to identify what kind of information exchanges are required and, hence, where we need to develop standards for those information changes, so more of a top-down approach for doing that.

So there are going to be times when we've got -- we know we've got a technical problem we need to address and the standards community can focus on that, you know, in the old-fashioned way, from a pure technology-driven point of view.

But in the timing that is being forced upon us, if you will, but and I think rightly so, to quickly develop key standards for Smart Grid, we really need to have those architectural models in mind, I think as you suggest, so that we're very much focused on developing and improving, or extending standards to address elements of an overall architecture that can support the applications that we're trying to implement.

So we got to work -- you know, we've got to work both ways, support the core technical requirements we know we have, but make sure that these are being orchestrated in a way that follows a high-level architecture.

MR. GRAVELY: So I think we have some questions from the WebEx. Again, it’s kind of an open mike, so identify yourself and ask your question. If there are no questions, we’ll go to the next speaker.

And you have unmuted the line; right? Okay, anybody on WebEx just speak up to be sure it works.

MR. GUNTHER: Everything was crystal clear.

MR. GRAVELY: Maybe we have a technical problem, I don’t hear any feedback at all, so could we check to be sure, at least, that the people on WebEx have the ability to communicate?

SOUND MAN: We have the ability; there are no questions on WebEx.

MR. GRAVELY: Okay. So are there questions from the people participating by the WebEx?

SOUND MAN: No, there are not.

MR. GRAVELY: Okay, we’ll go to the next speaker then, thank you.

COMMISSIONER BYRON: Well, if I may, Mr. Gunther, I would like to -- it’s no problem, I --

MR. GUNTHER: These are important questions, okay.

COMMISSIONER BYRON: Well, no, they’re not. But I was -- I feel this presentation was really helpful, could have brought a lot of structure, maybe, to some of the discussion at our panel yesterday morning got into as well.

I particularly liked the notion about making sure that we get true cost to consumers, so we get the correct incentives in place for them to manage their usage. I think that’s a crucial element, and we don’t quite have that right, I know, in California.

But a couple of quick questions, if I may? One is you said something about the grid being different from the internet, but as I thought about it, and I know you’ve thought about this a lot more, there are some parallels. One is it’s extremely reliable, it’s self-healing, there’s two-way communication, the standards for the most part are invisible. I don’t think consumers know or see anything that give us a sense that there are standards, although I suspect there are some significant standards in play.

And security was important when we started to introduce the transaction of money in the last 10 or 12 years.

MR. GUNTHER: Yes.

COMMISSIONER BYRON: And we figured security out as a result.

MR. GUNTHER: That’s right.

COMMISSIONER BYRON: So isn’t there a lot we can learn from the internet?

MR. GUNTHER: Oh, a huge amount we can learn, and are already being adopted. Most of those technologies are already being used and adopted in some of the utility-specific technologies.

MR. GRAVELY: So people can hear you, speak into the mike.

MR. GUNTHER: Oh, okay.

COMMISSIONER BYRON: We have a sound problem in this room; we have to get close to the mike in this building.

MR. GUNTHER: Very good. Okay. Yeah, usually people don't have too much trouble; I tend to be a little bit too loud sometimes.

But anyhow, yeah, those technologies are fundamental, the security technologies in particular. Some of the subtleties, you know, get lost.

You know, the IP -- the IP protocol and the whole suite of internet technologies is very broad, it's not one thing, and so trying to figure out which of those elements to bring to specific power system applications is sort of the challenge.

So is it the addressing element, is it secure sockets layer, is it the way you represent, you know, packets in a certain way?

So when we talk about applying IP technology, you got to let a lot more specific as to what you really mean, and that's one of the things we see as not happening.

The other aspect of it is there are many times when the overall complexity, due to the generality of IP, you know, it doesn't make sense to implement, in this little, teeny device that, you know, you've got to -- you've got about a tenth or a hundredth of space for storage or in the embedded system of an existing device.

So it really comes down to tailoring those technologies and identifying which pieces of them make sense to deploy. But that's all -- it is already happening.

COMMISSIONER BYRON: While we're moving forwards with standards around Smart Grid, you must be tracking, to some extent, how various AMI programs, grid control efforts on the part of utilities, the consumer interface issues, you must have a sense of how the various utilities are doing in this regard; do you have any bad examples for us?

MR. GUNTHER: Now, you're going to get me in trouble.

COMMISSIONER BYRON: Outside our State, of course.

MR. GUNTHER: Yes, outside the State. I'll give you an example. I was at a -- I was presenting at another state Smart Grid workshop last week, and a representative of a utility was describing their -- some of their AMI pilot deployment, and was describing how their security was good because the meter vendor technology was secret, no one knew about how it was done, it was proprietary, and even though the data was not encrypted, no one could figure it out because of that.

That was an example, there's a lot of folks that still don't get it.

COMMISSIONER BYRON: Uh-hum.

MR. GUNTHER: And I couldn't believe it when I heard that.

So here in California, you know, the utilities are very, very much on the ball, have really been leading the effort nationally to develop the security standards, the business models and the like. There's a lot of work to do nationally, but California is leading the way and especially the California utilities right now.

COMMISSIONER BYRON: And so I take it they're very involved in the standard process here, then?

MR. GUNTHER: Very much so. All the utilities here, in California, are actively involved in users groups, standards activities; they're all heavily involved in the NIST activities.

So it's been -- over the past several years it's been amazing to see how the utility community has really stepped up to be very open in sharing the information that they've developed internally, and especially in California and leading the way, so that's been refreshing to see.

COMMISSIONER BYRON: Good, thank you.

MR. GRAVELY: We have one more question. I'll let you go ahead and read the question and answer, from the WebEx.

MR. GUNTHER: All right, let's see, hardware -- hardware network is standard for the Smart Grid, how can we get manufacturing to come together? The hardware network is standard for the Smart Grid. Boy, I'm not sure I really understand that.

But as far as getting manufacturing to come together, if what I'm reading between the lines here is how can we get the manufacturing community, the vendor community to start implementing standard-based solutions, well, the utilities got to put it as requirements in RFPs. And that's been the case for a long time, if you don't ask for it; you're not going to get it.

So if that's what the intent of the question was, that --

MR. GRAVELY: Okay, thank you very much.

MR. GUNTHER: Thank you.

MR. GRAVELY: I'm not sure, normally on the WebEx we're able to hear people talk out in the air here, so I'm a little concerned that we're not getting the same WebEx support that we normally give.

So anyway, those of you on the WebEx that have questions, please type those questions in. If we interpret them incorrectly, you let us know and we'll try and work it out. But we don't seem to have the ability to hear the people on the WebEx, at any rate.

So the next speaker today will be covering one of the other -- one of the other white papers we discussed both yesterday and today on energy storage.

And Richard, from KEMA, will be giving that information and answering questions. And, of course, energy storage is a very inciting topic, so this is helping us bring together how we can use storage.

And we heard yesterday we have a group that's working on how to break down some of the barriers that storage has, that maybe the policy makers and Legislators can help, so this one here is going to talk a little bit more about how storage can be applied and how policy can help.

Richard.

MR. FIORAVANTI: Thank you. I hope everybody can hear me; it's a little bit easier for me to get closer to the mike than Mike and Erich.

So I do want to thank the Energy Commission for giving me the opportunity to speak.

It's a very exciting topic and we're hearing a lot of folks discuss it in many ways. In fact, I was at a workshop in D.C., on Monday, and a very high-profile speaker was commenting on storage and said, well, when storage happens that changes everything.

And that’s great and we believe that as well, but we’re -- for this case we’re not trying to change everything, we’re trying to help California reach its goals and utilize a tool that can help that.

So we’re trying -- with this presentation, I was just hoping to focus some of the activities we’re seeing into what we’re -- how we’re going to help -- how this is going to help your goals with renewable energy and policy.

It’s actually part of the white paper that my colleague, Dr. Masiello, is going to be speaking about right after I speak. But the fact that it’s such an important topic, we wanted to give it a little bit more attention overall.

KEMA has been working with clients for over 80 years. I put this slide up basically because it shows that we have been involved in both the consulting, the testing and the certification. We are an independent evaluator of these technologies, and it has given us the opportunity, because we have testing labs and we’ve been working with -- certifying a lot of these new technologies and these advanced technologies, we’ve had our chance to get our hands on them and wring them out, and work them through some of their performance characteristics, and understand their capabilities a little bit more than what you typically see, which is why we've had a lot to offer in this case, but it really touches on some of the aspects of what's going on.

Also, we do have our lab; we have actually a dedicated test lab in Arnhem. There was a question about whether these issues are happening in other places. They are, we actually -- we are getting questions in Europe about how these are -- these same impacts that we're discussing today are taking place there as well.

So we are seeing it everywhere, actually, not just in the U.S.

What I was hoping to talk about today was really how does storage fit into the Smart Grid and the California renewable energy goals?

Where is storage going to be utilized and are there gaps because of that?

What are the California options and, also, what steps are required to ensure the storage is fully utilized to meet California's policy goals?

And to start off with, storage has been -- it's now become a topic that covers all technologies, but we do see a lot of differentiation in them.

And what I'm trying to explain here is that, you know, what is new in this old concept? Because as you can -- as we know in California, pumped hydro has been around for a while, compressed air energy storage has been discussed for quite a while, so the storage concepts have been around for a number of years and actually have been utilized in the State of California. Pumped hydro is the most common form of that.

But the issue is geographic limitations make it difficult to be placed everywhere where you may want to utilize it, and with pumped hydro you may get some seasonal unpredictability because of weather patterns and rain that you receive in the State.

Recently, the advancements that we’re seeing in emerging storage technologies can really give you the option to provide this as a ubiquitous tool for the Smart Grid.

And where have these advances occurred? They’re really in some of the smaller technologies, battery, flywheel storage technologies, above-ground compressed air energy storage. Really, in the last three years, a tremendous amount of new technologies are being introduced and tested that have some unique characteristics that can be utilized as part of the grid, and really allow the ability to start focusing and putting strategic uses for it.

What type of improvements are these? It’s really the fast-response capabilities you’re getting on some of these technologies. There are multiple cycles, where before we were talking about maybe ten cycles in the lifetime of some of these technologies, now we're into the multi-thousand cycles.

And in some cases the transportability, which can solve some of the larger issues.

And we'll address another question that we had, I think that came up yesterday, is where do these go, where do we place these, and why do we place them in certain areas?

But are all the technologies the same? No, they're not. They can perform differently and they can excel in specific applications, so what we again what to look at is make sure we have an understanding of what each one does and where we can best apply them.

So what issues are facing California when we look about and talk about increased renewable penetration?

It's the increased regulations that may be required because of the variable generation characteristics of the wind and the solar that we're going to be hoping to implement in much larger proportions in California.

As a solution, it's believed that there's going to be a need for this, when we look at these curves, that when we see this intermittency, storage is a technology that can both help with that but, also, the regulation services, ancillary services that may be required from that are going to be issues that storage is going to be able to solve.

Also, when we start talking about with wind, the diurnal cycle issues about you want certain generation, these generations, they occur in times when the load may not be as great. Wind tends to peak in off hours, when demand tends to peak during the day.

With solar, we get it in the peak of the day, which is terrific, but now we're seeing peaks getting shifted to later in the afternoon when solar isn't able to supply power and energy.

So when you're looking at producing renewables, we're not always looking at how to study everything, but there's -- when we're looking at specific applications, we're also seeing the ramping issues around them, the rapid drop off that you may encounter, these are all issues that storage can help you solve.

So in each case it's the ability to capture renewable generation when needed. Smoothing renewable generation I believe to be essential for the increased renewable penetration. Which is why, again, we feel that it's an essential component for the California Smart Grid and going forward.

There we go. What we have here is just a couple diagrams that, again, reinforcing how we're looking at it. Now, when we start talking about storage, not just in California, but throughout the U.S., it's being considered a tool for the Smart Grid. And when we're looking at PHEDs, as we see in this diagram, of just a vision of the utility in the future, in the Smart Grid, you can see that plug-in hybrids are going to be part of this. The batteries of these vehicles, they're not just to be considered as loads, but you can actually utilize them as tools, and I'll get to that a little later in the presentation.

Also, when we start looking at the large generation, large solar, wind farms that are going to be part of this grid, we also see that storage as a component in that area as well.

So what types of applications are we looking to do storage to help in California? Again, when we look at the map below it shows the renewable penetrations, the goals that each state is having for these increased penetration levels.

And, of course, the focus on the State of California, but as we see where a couple years ago we were looking at five percent penetration rates, now we're talking 25 to 30 percent.

So across the U.S. you're seeing just a consensus being built around the fact that we need some additional support for this and storage is being talked about.

Again, repeating what's on the last slide, it's the integration of renewables that we're really going to be looking to utilize storage for, ramping, diurnal issues.

Ancillary services, we can talk -- we'll talk about this, also, a little later. The differences between market and independent players that are going to be utilized storage, but it's this increased need for regulation that is going to be foreseen with the increase in renewables, storage is going to be able to provide that.

And it's an exciting area right now because it's a market that's already available and already exists, and you're seeing players fill the space right now.

And of course with the plug-in hybrids, probably better to term these electric vehicles from now on as the convergence of the automotive industry with the utility industry, and are we going to be able to aggregate these and solve our problems that way, as well.

So storage can provide the answer but, of course, work still remains. This is one of the reasons why, you know, with the CEC and Mike's peer group why it's important for a lot of their work to continue.

It's an answer that we do believe is necessary, but questions remain on whether it can be ready at the price points we want, and whether it can be ready in the magnitude, the megawatt scale that's going to be required when we start looking at how much generation, renewable generation we're looking at for California.

So why is storage an answer, what makes it better?

It's the low emissions that we get off these technologies that make it almost, for California, really exciting.

We have seen in studies, Carnegie-Mellon has done a study recently that showed that when you start using natural gas generators to supplement wind, you're actually getting increased emissions from those generators in that type of application.

It's the variable ratio, when you start moving generators up and down you tend to get differences in their heat rates, which cause an increased emission factor. So in the sense of emissions, it really has some terrific applications.

We actually have even been working with the Energy Commission to help out with -- to investigate whether or not these can be used at commercial adjustment facilities as well. Again, once they're there, you can start seeing these as demand response-capable device, low-emission demand response-capable devices as well.

And so it really provides an alternative to traditional fossil generation and thus preventing renewable energy -- the renewable integration from increasing emissions for the State.

Again, multiple megawatts are going to be required to match the renewable policy goals that we're looking at. And, you know, the question is can the technologies be produced fast enough? The answers are really the basis for the PIER activity and the focus efforts we have going forward.

So what are the options? I know there's a lot of discussions about different types of storage technologies, what we try to emphasize is that storage technologies are not equal in capacity capability or performance characteristics, and we need to encourage the right technologies and the right technologies for specific applications.

Additional regulation is believed to be required for our 33 percent renewable energy goals.

For these type of needs, when we look at ancillary services, it's really only the shorter duration that is required for this, so we can utilize many different technologies for this.

The options that are currently being evaluated, the CEC has worked with Beacon Flywheel; the AES Corporation is working with the CEC to demonstrate a lithium ion system, and a123 batter. AES has been pioneering a lot of efforts and doing a terrific job in helping the State of California in that area, as well.

And there's other technologies that are being now tested. Lead acid, advanced lead acid, the next generation of lead acid is also providing terrific alternatives that can be utilized for this.

But again, for everything that we do, price is a legitimate concern, but the performance characteristics and the emission benefits really provide some compelling reasons to go after these type of applications and really take a good look at them.

On the larger issues, when we start talking about the 100 megawatt, the 250 megawatt range, you know, we may be able to stack many of these other battery devices together, but there are also many other technologies that can -- that may be more applicable.

And in this area, of course, pumped hydro is still going to be something that we want to utilize, but compressed air energy storage offers the capability to reach the megawatt levels that we need.

And what you’re seeing there is a picture, it’s a large scale, but we still -- we’re going to get similar constraints that you may get with the pumped hydro, they can’t be placed everywhere. And in response to that there’s a lot of activity going on, an interest in above-ground storage. It’s not truly above-ground, but it does provide an alternative to get large-scale applications and at a price point that may be beneficial for society as well.

The advanced systems I think are being proposed for both the East Coast and West Coast on the U.S., so there’s some exciting options being examined in that area as well.

The other point is, you know, again as we started talking about the electric vehicles and how we can utilize them as a tool, the picture really -- what I’m trying to show here is that when we start looking at the technologies that are being used in the electric vehicles are the same technologies that are being put into these utility megawatt devices.

And when we start aggregating together, as you see with this picture, you know, a number of these cars, it’s really going to be actually the same way as these large devices will.

So it’s a reason to look at this as the aggregation component, which Smart Grid is going to be a necessary component to do that. There’s enormous capabilities we can get when we start thinking about aggregating these devices together and using them as tools for demand response, for ancillary services, for spinning reserve because, again, it simply just acts the same way as we’re seeing right now in the utility scale devices.

And you’re seeing this being applied right now, AEP is working about this community storage technology that’s being discussed, where you’re really taking these devices and you’re using small-scale storage. Again, the same components make up the same devices, acting the same way.

You're looking at these, when we start talking about transmission and distribution applications, where you can help with peak shaving, reliability and deferral, you have the ability to use some of the large flow batteries and the megawatt scale, but also even at the fetal level you may have the ability to bring these down to the small, 20 to 50 KW scale and place them in many, many places throughout the grid.

Again, price is a component to this, but when you look at what is going on with the electric vehicles, as these electric vehicles use their batteries, these batteries actually may find a home in these type of applications, greatly reducing the price that it would cost for these things to be implemented and, again, providing a terrific motivation to utilize, to utilize the technologies.

So distributed, the term that's being used for that right now is community storage, it provides the capability to quickly ramp up megawatts, when you start aggregating them to the capacities that we're going to be looking for.

And, again, it's the advantages that the utilities are seeing in this area, it's peak shaving, deferral and improving reliability. And in some ways we even talk about how somehow the electric vehicles may be causing some issues, but their batteries can be put in these applications and solve their own problems, which is a terrific closive way of looking at it.

So for research and the focus for the Energy Commission, when we look at a vision for what storage should be, we see it as a component that should be used throughout the electricity infrastructure to support renewable penetrations in terms of the reliability, the economics, the operations and deferred capital. Appropriate storage technologies are integrated in light of all these applications.

Where we think a lot of the focus should be, it’s really the modeling, the analysis to determine how much storage is required and necessary for California. It’s an open question when we start looking at where we’re going to be putting these and how we’re going to be installing them. It’s really, you know, the other question is how much do we really need, and that’s something that only through modeling and investigation are we going to answer those questions.

The role source is going to play in helping this State achieve it’s zero energy residential and commercial use construction, storage can be applied at the smaller level for residences with their solar applications and other renewable applications at that level as well.

What are appropriate regulatory, market and incentive treatments to encourage storage in support of renewables?

Storage, again, we ask where does it fit? Does it fit on the TND side; does it fit on the merchant power plant side? The answer, it tends to be both.

And I've mentioned this before that it's wonderful to hear somebody, other than a consultant, say the answer is maybe, but a lot of folks are realizing that this technology has applications in many cases, but it will create a stress on our current regulatory policies on how do we classify it and what do we classify it as.

The other issue, and this again something that we're currently working on right now with a wind farm, is how to integrate the control technologies that are going to be used to integrate these.

And this is a little bit more than the how's it going into the Smart Grid, it's really how do we get a wind farm and a battery or a storage technology working in concert with each other, as it's required to maintain greater reliability.

And this really is when something happens at the renewable generation device, the battery's going to need to react in a certain amount of time, how do we make sure that happens smoothly?

That's an area that we're actually currently working on. One of the first wind farms that are addressing this issue came as supporting that algorithm to try to create that.

But it’s an area, again when we start talking about the standards that are going to be required, that is a key area and it’s only really going to be discovered as these wind farms start adopting these technologies and moving forward with it.

And again, we use the term wind; the same applies for solar as well.

The investigation of the emission benefits of storage technologies, again, commercial and industrial uses. When we start thinking about the capability, if you replaced back-up generators at industrial facilities with storage devices, as storage devices start increasing their capacity, their duration, their transportability, and their ability to use multiple cycles of it, it starts looking very much like distributed generation as opposed to just a battery device.

And if you have that capability that you can now tap into that, the amount of megawatts that are available if you tapped into a demand response tool is really quite impressive. And because it’s a low-emission device, you actually will be able to utilize that.

And so this is another area that we’re currently working with the Energy Commission on to try to identify.

And then when storage is used in multi-purpose applications, how to allocate the cost and the benefits of the cost recovery is a key -- a key question.

One of the points I like to make when I start talking about emerging technologies is we've seen a lot of this before with distributed generation, of which technology is really going to be counted on and relied upon in the future, one of the keys to identify whether a technology has a future is, is it going to be solving a specific problem that people are facing?

And we're seeing this right now, it can solve ramping issues, it can be working as a better alternative with ancillary services. So folks are going to look to implement these technologies for these specific applications, but now we're seeing these multiple revenue streams that you may be able to generate, and there's multiple applications that could be used when it's utilized in that one spot.

And that gets, you know, back to this question of where do we put it? You're going to be seeing it being placed at wind farms because the wind developer has a specific need he needs to use that -- utilize that device for. But now that it's there, he has the capability to enter into other markets with it, and you have to have the capability and the regulations to allow him to do that. So that's another area that I think is going to really be deserving of a lot of attention, is how do we address these multiple applications, multiple-purpose applications to allow it to be utilized to its fullest?

So how can we allow increased applications and concepts to participate?

Again, the question, what can stakeholders do to increase storage applications? And again, it seems like each day there's a greater understanding of the capabilities. And back to that original point about it changes everything, it seems like there's a new idea and a new application that's being utilized as more and more folks understand the capabilities and the potential capabilities of this technology.

But manufacturers are rapidly entering into this market place. It's not just, you know, some of the same characters and manufacturers we've seen before, but additional players in defense satellite, and then folks also moving some of the Asian manufacturing, that we're seeing in these technologies, to the U.S. They're all, simultaneously, looking at this market as well.

As we like to say, as the light gets shined on these applications, you're seeing more and more folks get interested in it.

Defense and satellite companies have been working with the technologies and these advanced battery technologies for 20 years, and now they're seeing there's an opportunity to be placing this in large-scale applications in other places.

So even though we're working with folks now, I think just in the last April discussion we've had, we've actually had three -- three additional companies come in, new companies come in with ideas that they think will be just as applicable, so it's very exciting about the opportunities.

But what does this really mean, is that for the manufacturers, the questions they're asking are really just tell us what you need?

And when we start talking about how stakeholders can help improve this, it really leads to the factor of almost to the point of don't get in the way. Because there's so many people, and there's a lot of well-financed and extremely bright people, and terrific companies looking at this, they're really asking the question of just tell me what you need and I'll produce it for you.

And it's a way that you see where the markets really will work, as we see in the ancillary services applications, and some of the efforts that the AES Corporation's doing right now. When there's an opportunity, markets will fill that gap.

It doesn't fill all of them because there's so many applications we can look at, but we do have to acknowledge the fact that where there is an opportunity for new markets to expand, developers, manufacturers and entrepreneurial corporations will really look to fill that gap.

Additional means to remove barriers in the storage, the focus area is education, standards, you know, as Erich correctly pointed out, testing and the grants that are out there.

With education, as you can see, there’s so many different applications of storage, you really want to try to make sure each -- everybody understands how to use this and it doesn’t get merged into just one omnibus topic that everybody thinks -- for example, some battery technologies can be applied to diurnal cycles, where duration really is what’s going to drive those.

So I think there’s a lot of activity going on both in California and throughout the U.S., and we need to have some type of clearinghouse of information so everybody can tap into it, because there’s demonstrations that are going on right now that I think are very helpful, and will help policy makers going forward.

The standards, of course, again, when we even start talking about how do you nameplate some of these devices, it’s a question that you’re going to see asked quite rapidly, you know, we don’t have answers for that yesterday, or today.

And grants, you know, I always make the analogy to fuel cells and micro-turbines, technologies that are so far, in some views, far off as trying to meet their price components, we have multiple grants already for those. Here we have devices that are already being demonstrated and put in the field and we want to see more and more activity to support that.

And, of course, we have the Stimulus Package that is helping in a number of ways. So I think that is already happening but, again, the more support we can get, the better off we're going to be.

Again, I think we've touched on the standards and the issues for that enough. But also, we start looking at the testing that's being done, this is something there just can't be enough of at this point, because these technologies are very, in some cases very new, and the only way we're really going to understand them is to get them tested in the time that needs to be tested.

There was one application we did when we looked at five weeks of testing, and the DOE came to me and said I need -- I need two years. I want to see it happening in an Albany winter and a Southern California summer to see how these really work.

And so the duration to these testing demonstration projects is also key to make sure what we need.

In some cases, folks are getting so excited about the concepts and the potential that we have, that the concepts seem to be out-pacing the real engineering technology and demonstrations that are typically done, and we hope that doesn’t happen going forward.

So that’s what I have. Again, there’s a lot here. But if you have any questions, I would love to answer them today or -- do you want to see the mike for that or --

MR. GRAVELY: Yeah, I want to -- I think we’re having some -- come on down if you have a question, and then there’s some questions on the WebEx, we’ll end up just reading them it looks like. I don’t think the audio’s working properly. I’m not getting it; it looks like it’s not coming to me.

COMMISSIONER BYRON: Mike, let’s go ahead with some questions, Mr. Fletcher’s here.

MR. GRAVELY: Yeah, you’ll have to bring the cards down because I’m not getting the questions on our screen.

MR. FLETCHER: Okay, this is Fred Fletcher, of Burbank Water and Power, representing the Southern California Public Power Authority.

And we are very interested in the storage technology. We’ve done some work demonstrating ice storage these last two years, and we’ve gone through and we’ve seen how it works out on the macro-scale economically, but now we're getting that reality of trying to put it into the market place, and it doesn't pass the TRC, total resource cost test.

MR. FIORAVANTI: Uh-hum.

MR. FLETCHER: When we run through the TRC, it comes on with a fraction of what these technologies cost. But I know intuitively, an electrical engineer, the value of the storage is there, but when I apply like a TRC cost it doesn't work very well.

MR. FIORAVANTI: Right. And the question is, I mean, how should we --

MR. FLETCHER: The question is if solar is so good, if the storage is so good --

MR. FIORAVANTI: Right.

MR. FLETCHER: -- why can't it pass a simple test that we've all decided is the good litmus test of what should be done and what shouldn't be done, and this indicates storage should not be done.

MR. FIORAVANTI: Well, it indicates that there's still a price level that needs to be achieved before it really becomes fully commercialized.

And I think it's key to note that there's a lot of development going on this area, but I don't think I would classify a lot of these advance storage technologies as being fully commercialized at this point.

And part of that is, again, finding out what the application that they're going to be under and what type of price points they have to hit for that.

But to say that a technology, an emergent technology has to be stopped because, you know, five years down the road there's no hope of ever achieving that, I think that's silly.

It's with any emerging technology, trying to know what that price is going to be is a game that, you know, many people fail at when they're trying to play, but we should just look at the applications right now and try and encourage these new technologies, to go after them.

MR. FLETCHER: Okay, let me see if I got your answer right, and that is that what you're saying is in fact the technology as it stands, at that price point, would not be cost effective no matter what the market structure was?

MR. FIORAVANTI: I don't think I said that. I said we have to look at every application specifically.

MR. FLETCHER: Yeah.

MR. FIORAVANTI: And one of the reasons why, again to my last point, when we were talking about the multiple purpose of it, that's why a lot of developers are looking at it. In some cases it's required, for both societal benefits it's required to help with the integration of some of these renewable technologies. But once it's there, yeah, we have a question of how do we want to pay for that.

There’s two, there’s multiple issues for that. There’s both these technologies hitting price points that are going to be economic for folks to use, but also the ability to tap into other revenue potential applications for it are also going to be needed.

Now, when you start -- again, if you look at the community storage application, for example, if you started looking at it with some advanced, new technology, even a fuel cell, it would be very hard to try to make that work.

But when you start envisioning the fact that some day we may be using used electric vehicle batteries for these applications, it actually becomes extremely compelling to try to use that.

And in cases right now, when we start looking at ancillary services, there’s some compelling reasons for that as well.

So I think one of your -- I don’t want to say a mistake, but I mean one of the things you need to look at is, again, you can’t lump storage into just one topic, into one specific application or look at one application and generalize that across the whole spectrum of technologies and applications, because there’s many places where you’re going to be seeing this work.

MR. FLETCHER: Okay, let me try another one then.

Perhaps the total resource cost test isn't the ultimate test for whether storage is effective or not.

MR. FIORAVANTI: I'm not sure of the test that you want to use for that. I mean, again, it's --

MR. GRAVELY: Let me help a little bit here. I've been involved in this for probably 20 years, and I think what you're running into is that in many cases you measure it, and how you measure the value, it varies on almost a case-by-case basis, the history has proven up until now, in most cases storage is not economic in the pure litmus test without having multiple value streams, and there's one of the discussions we had as an analogy we talked about at the Storage Workshop, storage could be doable, the viability of wind integration and ancillary services.

And if you add the three together it was very cost effective, but if you took any one of those by themselves and said that's all it's going to do, it would not past a cost effectivity test.

But the other challenge becomes how you measure that effectivity and how you give it a value. In some cases the value that storage provides doesn't have an economic relationship.

So I know the project you guys are considering is very creative, but I think you're going to find in today's technology and today's prices that a single application, I’ve seen very few single applications that will price justify storage on its own, or you will find that there’s not that many out there.

Now, there are certain cases, certain cases and certain customers, but in the case of a general -- we look at the price of electricity, and when storage is replacing the price of electricity, things like $500 a kilowatt hour for a system, a thousand dollars a kilowatt for a system, those types of price breaks. I think you’re going to find as you do your detailed analysis that there is -- it’s like, okay, it depends, it’s always on a case-by-case basis. I’ve yet to see any documented evidence of a business case that would work across multiple applications and multiple technologies, so far.

MR. FLETCHER: Well, I look forward to looking into this in more detail because it is an exciting concept and a challenge, not only from the stand point of technology and engineering, but also from a marketing and business stand point as well. Thank you.

MR. FIORAVANTI: Okay, great.

COMMISSIONER BYRON: I want to add just two cents to Mr. Fletcher’s -- I think it’s a great question as well. I think the regulators have a way of getting this fixed as well, as Mr. Gravely indicated, there are revenue streams associated with storage that we need to quantify. There’s one of them here, too, storage doesn't produce a greenhouse gas. And so when we add those costs in, storage is going to begin to look more attractive.

But I think there is -- part of it needs to be fixed at the regulatory level as well.

MR. BROWN: Merwin Brown.

MR. GRAVELY: Uh-hum.

MR. BROWN: This question is on the heels of the question that was just asked, it seems to me that the dilemma occurs because of the schizophrenic characteristics we give storage, which is it's either got to be a generator or it's got to be a load.

And I'm wondering though, in your talk what struck me is that in all of these cases it's really a power flow control device on the grid, and it's a temporal power flow control, either milliseconds or up to days.

And so if we looked at it in that sense, would that change the way we might want to value the storage? And I realize that opens a can of worms for regulators and others, but just a thought, and I'd like your thoughts on that thought.

MR. FIORAVANTI: Well, I've heard that before that, you know, we should think about this as a control technology for utilizing this.

At the same time we have to look at the fact that there are markets, and markets where people can utilize these devices for profit and with ancillary services, for example, which are going to be driving a lot of these applications as well.

And I do have a lot of trust that that could help it, but I realize that there's societal benefits, there's benefits that the regulators may also want to try to capture that can be tapped into for these devices.

And again, you don't want to group one term or one type of technology across the entire board. But I think the step of thinking about this as a control technology is a very positive and very good step to take.

MR. REINECCIUS: My name is Stacey Reineccius, I'm Chairman of Powergetics. We are actually a distributed intelligent energy storage developer for the customer side of the meter, not the utility side.

I just wanted to share a couple of points that your talk brought up and some of the other conversations here, in our efforts to actually bring this to market.

One is getting access to real-time information and lowering the cost of installation would be a real enabler. That has been -- it addresses standards, it addresses some of the regulatory issues, but it has been basically an impossible task and we've had to actually proceed to develop our own measurement tools because the existing tools, and the existing Smart Meters don’t provide enough information, they’re not open enough. Access through the utility databases, which are non-real-time, is inadequate to actually deliver real value in case of storage on a customer premise.

Another is that storage right now, in the current California and Federal regulatory and incentive programs is disadvantaged. It is geared very much towards systems that are 30 kilowatts or larger, which eliminates a huge number of very practical applications, including PHEV matching, where you might be able to have a system on site that is storing cheaply at night, or storing from a renewable, but is not able to be 30 kilowatts or larger, it doesn’t need to be.

Another factor on that, for example, might be allowing stand-alone storage applications. Those are completely ignored at the present time.

In terms of that what I mean is being able to take a storage unit and connect it to a pre-existing solar installation, or a pre-existing wind installation, or water installation, or even putting it into a location where there is no possibility of putting some renewables on, but you could still get benefits.

To the speaker’s point about multiple applications being necessary, absolutely, I think you need at least three different applications to make an installation profitable.

Another point of parody is that storage right now is not supported, although it's mentioned all over the place in the Stimulus Act, is not supported in any practical manner. There's no parody on the Investment Tax Credit, there's no parody on the accelerated depreciation. And that, I think, is critical, especially if you're trying to get renewables combinations with it, if you have an entire section of the installation that now is disproportionately expensive, it's kind of pointless to try that, you have to go another route.

And on the -- we have done some study, that I'd be happy to share with the panel, showing some of the potential, actual greenhouse gas benefits of doing storage shifting, because of the energy mix differential.

MR. GRAVELY: Speak closer to the mike, please.

MR. REINECCIUS: Sorry about that. Is that better?

MR. GRAVELY: Yeah.

MR. REINECCIUS: Just to say that there are in fact potential greenhouse gas benefits from stand-alone storage applications as well, for a variety of reasons.

So those are my comments. And one suggestion I would have is definitely any work that's done is let's try to get it so that the information at the premise is as rich and as open as possible, and that will open a lot more applications for storage and other programs around storage, and get the storage to be on parody in regards to regulatory treatment with other renewables. Thank you.

MR. GRAVELY: Good. Go ahead.

DR. KARPOFF: Good morning. My name is Peter Karpoff, and I'm here speaking this morning as an individual.

I think the emphasis on storage here, this morning, really shows that it's a key element of what we need to go forward, and I wonder if there's a real fork in the road here.

Erich has talked about the centralized utility storage and the intense communication, somewhat daunting communication requirements associated with that.

And on the other side we have the possibility of maybe storage at the customer's premises, as the previous commenter has indicated.

And it seems to me, in the customer storage situation, the communication requirements are much, much more limited and it may be limited only to two points of communication.

One would be for the utility to communicate to that customer some type of time-of-day pricing. The customer has a computer that lets him sort it all out and decide when he wants to consume, when he wants to store and, indeed, when he wants to sell.

And the second point of communication is to have him decide whether he’s a taker of power at any particular moment or a sender of stored power.

So I hope before choices are made that both forks of this road are fully explored. And it seems to me, with the reduced communication requirements with decentralized customer storage, the cost might be less.

Now, we would expect the centralized storage to reap some economies of scale and all that sort of thing. But one alternative, at least in an analytic sense, I think is to look at disaggregated storage in the more limited communication requirements, and then to see if the utility with its economies of scale and expertise can do better than that for the customer and, if so, sell it to him.

But I think there are two important alternatives here for this important storage contribution and I hope they’re both examined fully.

MR. FIORAVANTI: Okay, thank you. There’s a lot of -- a lot of questions and issues. I mean, one of the ones we’ve postulated before is if you put it next to a wind farm and you store wind energy and then you discharge at a later time, are you actually discharging renewable energy, are you now open to a bunch of credits and investment tax credits because of that.

I'm not sure. Again, there's many applications that are being envisioned. And to have policy and the regulatory issues all catch up to it immediately is going to be difficult to happen. But I think it's important to mark them down and understand where it can benefit and then move, and try your best to keep up.

There's a couple questions that have come in.

MR. GRAVELY: Yeah, go ahead and answer them.

MR. FIORAVANTI: One of them was from Patricia, in Palm Springs, about "we live in Palm Springs, what do you know about the progress here regarding Smart Grid and what is the shortage route to achieve electricity cost reduction?"

It seems to be a more general question. I know storage has been envisioned as in some alternatives to try to capture, expand solar energy and utilize it later on in the evening, to try to just expand the capacity that you're going to get out of that device.

But also, you have -- you want to answer the question about the Smart Grid and --

MR. GRAVELY: Yeah. Well, yeah, and these next two I can maybe provide a little bit. And that is the specific areas of what Smart Grid; you would talk to your utilities. The utilities, I know in the area that we're investing in, we are doing some work with water utilities in that area, and we’re not doing any specific work with the local utilities for Smart Grid. But it’s obviously an area where renewables is a huge part of that particular area.

So I don’t know that we are -- I’m not personally aware of any specific Smart Grid demonstrations or specific Smart Grid initiatives that are coming out of the Palm Springs area, other than the increased emphasis on renewables.

The other question here that was asked is “has the inverter problem been solved for solar flow?”

And I’m assuming you’re talking about two-way flow and net metering, and I think the answer to that question is it is -- we are doing considerable research in the area of inverter development for both cost and performance. We’re doing research on the grid because of the two-way flow of power versus one-way flow of power.

So I wouldn’t say it’s only an inverter problem, but I do think inverters are a part of the problem. If you would consider this, and I would say that we are addressing it with research, I think we are addressing it with policy in the area of some of the net metering types of legislation and net metering types of tests. But I do think it’s an area that needs considerable more work.

And so do you have any questions before we --

COMMISSIONER BYRON: Not necessarily a question.

Let me finish with this before we go to break?

MR. GRAVELY: Sure.

COMMISSIONER BYRON: Let me say it correctly, Mr. Fioravanti?

MR. FIORAVANTI: Yes, that's perfect.

COMMISSIONER BYRON: Very good presentation, thank you. And, of course, there's a lot of interest in the topic of storage. Good comments, two questions.

I would add two other reasons that storage is going to be critical going forward here in California and one is it's going to get hotter. I think we're seeing these kinds of peak summer days increase.

People like Patricia, and a friend of mine, Jeff, who just moved to the desert, these people want to live where the climate is nice and the AC is expensive. And so we're going to see increased air conditioning load, and peak year load, and storage is going to become more critical for that reason.

It's going to also become more critical because it's becoming very difficult to site the alternative, and that is fossil-fired power plants.

And so storage is going to be playing a critical role.

Some of the questions along the line of the regulatory process, getting the revenue streams correct, it’s paramount that we do this. I think we are looking at some key recommendations to make in this policy report, this next time, around how California can help get those revenue streams correct.

We’re seeing some of our utilities move forward with storage programs, storage demonstrations. We need utility scale storage. We’re seeing some of those kinds of projects come in.

One that you did not have on your list is possibly a closed pump storage system and disbursed thermal storage is one that we discussed. These have great potential.

We’ve got to get the revenue streams right and the ability for utilities to perhaps even take on the cost structure of these and put them into their rate basing.

So thank you very much for your presentation. I let you have the last word, if you have any final comment. But I think we need to go to break, is that correct?

MR. FIORAVANTI: Yeah, go ahead; I’ve finished with my comments.

COMMISSIONER BYRON: Go ahead.

MR. FIORAVANTI: Well, also when you look at the relying on pump storage, having lived in California for many years, I would watch the rainfall totals every winter, as everybody here does, and as that becomes more variable and less reliable as to how much rain you’re going to get, how much storage, the ultimate storage we have up in the mountains of California, that also makes you want to rely something less on that and more on devices that you can count on, which you have with the utility scale storage devices.

COMMISSIONER BYRON: Uh-hum.

MR. FIORAVANTI: Thank you.

MR. GRAVELY: Thank you all. It’s very enjoyable to have a topic of huge interest, but it’s terrible when you’re maintaining a schedule.

So let’s take a short, ten-minute break, and we’ll come back and try to complete the morning session before we break for lunch.

(Off the record at 10:58 a.m.)

MR. GRAVELY: For the rest of the morning here we’re going to be talking a little bit from -- Ralph Masiello, from KEMA, is going to talk to us about the white paper they’re developing for us on the 33 percent renewables.

Then we’re going to hear from Sac State on the Smart Grid Center work that we’re doing with them, and the local utilities are doing with them.

And then we’re going to hear from Richard Schomberg, who talked yesterday, also, but today he’s going to share with us what’s happening in the Smart Grid internationally, I think you'll find it very useful.

I will say that we are a little bit behind. We should have sufficient time to hear everybody, have some brief questions, and we'll do our best. We are planning on breaking for lunch a little later and starting a little later, and hope that will help in the local area, with the lunch crowd.

So with that I'd like to put the charts up here real quick for --

MR. MASIELLO: Yeah, please, I can't talk without the charts.

MR. GRAVELY: Let me find your presentation. Here it is. Is this the right one?

MR. MASIELLO: It looks like it.

MR. GRAVELY: So, hopefully, with the right charts. If not -- is that the right presentation?

MR. MASIELLO: Yes, it is.

MR. GRAVELY: Thank you very much.

MR. MASIELLO: Good. Thanks, Mike.

This is a project in, really, December or January of this year, to develop a roadmap for future Smart Grid research, focused on the goal of how can Smart Grid help facilitate the 33 percent renewable standards or even higher.

So the project's close to conclusion, to support the IEPR process -- process behind this work and the conclusions.

So the steps in the project that the CEC had requested were do a market analysis of what's happening with the technologies today, trends, growth patterns, and then what are the factors that are affecting the development and deployment of the various technologies.

And the factors could be is the technology ready yet, is it too expensive? It could be regulatory issues. So those are two that we've heard about in the context of storage in length just now.

Or are there other technical issues, such as standards development, that are obstacles?

What's the relationship of Smart Grid to renewables penetration and that's really the core of the work, developing a matrix that match Smart Grid technologies to how you facilitate renewables.

And out of that what are the gaps, what are the R&D recommendations?

What is Smart Grid in this context? Well, soup to nuts, the transmission level, phasors, FACTS devices, new technologies such as dynamically insertable reactants -- a show of hands, how many have heard of that one?

Okay. Well, some people at Georgia Tech have a clever device that clamps or, if you will, wraps around a transmission line conductor and can be used to dynamically increase the reactants of the line, and it’s a way to relieve congestion on transmission lines that are subject to parallel flow issues.

So in the distribution level, substation and distribution automation, but we also looked at the back office applications for engineering and planning, for instance, as well as protection.

Storage of this metering; home automation, which we heard quite a bit about today; and a topic that doesn’t get addressed very much, which is commercial building automation systems, or B to G, as it’s now called. So that’s the gamut of the technologies.

So the first step is to say if you’re going to facilitate renewables penetration, what are the things you’d like to accomplish?

You’d like to make it cheaper and easier to get the renewables installed, so reduce the capital costs, reduce the interconnection costs and complexity.

You’d like to increase the revenue streams available to the renewables, so that could be market participation.

Now, of course, today a wind developer would recoil in horror at the words “market participation” because they’re better off as a price taker, with all costs socialized.

But realistically, at 33 percent RPS there would be times of the day when renewables are 50 percent or more of production, how can they not participate in markets. Right? So you have to go there and talk about it.

Reducing curtailments, West Texas is a great example. Wind farms in West Texas get curtailed routinely at night because there’s not enough transmission capacity. It leads to storage economics and other things, as well as the C/Res zones.

If we can reduce the system costs associated with renewables, whether it’s transmission capacity, or additional controls, or operating measures then that’s good.

On the wholesale economic side, how can Smart Grid help with congestion costs, losses? Capacity payments to generators, which could be an issue here in 2020. Right now, current paradigm, someone’s going to have to pay generators to stay in service, to provide backup and levelizing, even though they’re not operating at high enough capacity factor to make money. So what can we do about that?

And then, importantly, functional value to the consumer and less inconvenient demand management is high on the list. If consumers are seeing their use of energy curtailed inconveniently, with a high frequency of occurrence, there will be tremendous push-back. The push-back over the Smart Thermostats is just a tip of that iceberg. So how can Smart Grid help that?

COMMISSIONER BYRON: Mr. Masiello?

MR. MASIELLO: Yeah?

COMMISSIONER BYRON: That's always done voluntarily.

MR. MASIELLO: Thank you. That was a heck of a straight line, but I'll let it go.

Okay, so if those are our business goals for renewables, what are the kinds of things you can hope to accomplish with technology? I call these tactics.

We heard quite a bit yesterday about the need for visibility of production, visibility of the installed capacity even.

If the homeowner puts in rooftop photovoltaic and applies for a connection, the utility knows about that first installation. But what if they go back to Home Depot and buy another panel and put it on at night? You know, the do-it-yourself crowd, I'm guilty, would cheerfully do that kind of thing, so visibility of capacity is an issue.

Control; being able to dispatch renewables is key to market participation, so that's an important tactic.

Coined the phrase green charging; the first thing with electric vehicle penetration is managed charging. And in a passing comment, in the middle of a project for the IRC, the Council of North American ISOs/RTOs, on impact of electric vehicles on markets and operations, and one thing that comes out of that big time is we get a million electric vehicles on the road that are capable of level three charging, meaning 60 amps, 220 volts, the impact in areas like California and the northeast, which is where they're going to be sold, will be dramatic.

So managed charging is not a desirable, it's a critical, mandatory thing we've got to achieve.

Well, the next step in that logic is the people who buy electric vehicles are going to be people who are motivated to reduce their personal carbon consumption, let's say, so they'll be the kind of folks who would also sign up for I'm going to run my car with renewable energy.

So how do we link the electric vehicle charging to renewables production somehow? Thus, the phrase green charging.

How far fetched is it? One of the Detroit automakers is looking into contracting for wind farms. And in the dealership, when you go buy the car, they'll ask you do you want to sign up for our wind farm? Not expecting to make money off the energy, but to promote the value to the consumer of the car.

Okay. Traditional Smart Grid capabilities, volt/var coordination, we'll get into that around inverted-based generation technologies, things very familiar, hourly pricing, dynamic pricing.

And then for completeness we think about the other strong Smart Grid motivators, T&D asset management and reliability, but those turn out not to be strong Smart -- renewables drivers, but we don't want to overlook them.

Okay, what are the technologies you can deploy to achieve those things, IED, phasors, bidirectional protection and control, the software to plan and operate using all these technologies, the automation systems and the substations?

If you start putting a lot of storage in substations, there's going to be new automation needs.

And I'll inject an anecdote here, I was talking about at the break, American Electric Power is installing a seven megawatt battery in a substation in Presidio, Texas. And they're doing this, putting it in the T&D rate base, not as a pilot, commercial operation.

The idea is it's big enough to carry the load for a couple of hours. That substation's served by one long, thin 69 KV line. And now, this is the anecdotal part, today, if they have an outage on that line, they get on the phone and they call the dispatcher at CFE in Mexico, who then manually connects to the line. They're not allowed to stay interconnected because it’s surcut, but that manual process can take hours sometimes.

Building another line is prohibitive, the battery solves the problem.

Now, here’s the regulatory aspect of that, if it isn’t well-known yet, when they applied to do this the wind community filed against letting them put that in the T&D rate base. Why, because they’re taking ownership of the energy in redelivering it, which isn’t the transmission function. The transmission operator in Texas doesn’t own the energy. So there’s an example of the regulatory construct.

Storage recovered, building automation. The building automation systems, in most sizeable commercial buildings, like this one, say, are pretty smart systems. You know, they have real computers, they have communications capability. Why would you interface to that through a meter? Why would you not interface to that building automation system the way you would to a substation computer, in terms of the amount of intelligence that’s there to talk to.

So instead of saying set back the thermostat, that building automation computer could be saying, in effect, here’s my demand time shifting as a form of storage, what’s it worth to you, Mr. Utility, examples like that.

With all the focus on residential metering, because that's where the volume is in these things, we haven't focused on this, which could be the low-hanging fruit, and commercial buildings are a huge percentage of the load.

Okay, PHEV, we covered everything except grid stabilization and that comes up as the first description.

Okay, I talked about a matrix, you can't read it, you can't read it in the handout. What we do is use the matrix to capture rankings and relationships here, from those tactics to the business objectives; and then a second one captures how the technologies support the tactics.

And we can use this to ultimately prioritize and value the technologies.

This is a deliverable in the report and the off-the-cuff proposition today is, if you give me your business card, I'll get you the opportunity to enter your opinions about the relative rankings of things in these matrices, so that we'll get a stakeholder process in this evaluation going.

Okay, first set of conclusions. At high RPS levels maybe half the generation will be inverter based, no rotating mass, no inertia, no governor response.

Around the world we do not understand the system stability implications of this change, what the grid dynamics will be when all that rotating mass is gone.

We've done studies in a couple of island power system situations, where the answers are not ones to make a system operator's heart warm.

So something's going to have to happen and it's a great place to develop high-speed control applications using synchrophasors. It's also a great regulatory opportunity to say to the wind and the solar development community, if you're putting in utility-scale systems, you've got to have synthetic inertia, synthetic governor response. That could be a market function of it's an added service you provide the grid and you get paid for it, or it could be an interconnection standard.

But we're targeting that as a piece of R&D, what should those standards be and how important are they?

A related concept around this, talking about storage again, you know, at the northern end of the 500 KV inter-tie, Bonneville's got this giant toaster oven, the breaking resister, and it's there to stabilize the western interconnection.

You could accomplish the same thing with a 300 megawatt battery at the southern end, connected to high-speed controls.

What are the economics of it? It depends on the relative economics of increasing the transfer limit on the inter-tie, so worth looking at.

Okay, closely related to this discussion is what can we do with the inverter electronics on distributed generation, as well as grid connected, to provide volt/var control? And this ties to the traditional Smart Grid goal of volt/var control loss optimization.

How would you integrate that with wide-area PME for stabilization or with other sensors-everywhere concepts for distribution and voltage monitoring?

After the previous paper and the questions, I don't know that I went to venture into storage. And I've given a couple of anecdotes already.

Rick talked a bit about community storage and let me amplify on that. What if you could put 15 kilowatt hours of storage by every distribution transformer? You could pretty much eliminate short outages, meaning outages of two hours or less.

Now, today that appears to be prohibitively expensive. But here's the link to electric vehicles, if in 2015 there's a million electric vehicles on the road, in 2020 there's going to be a million 20 kilowatt-hour batteries that have degraded to 16 kilowatt hours, that are coming out of the vehicles, they're perfectly good and in that distribution application they could last a long time, and the economics are interesting.

In working with the automakers, they're very interested in how we harvest some of that residual value. So there's a sizeable market opportunity coming there. And from the automakers' perspective, it's an infinite market. Right, there must be 200 million distribution transformers in the country. Worth thinking about.

So maybe with that, I'll not take anymore time with storage, after we focused on it.

At 50 percent of production off-peak, 30 percent on-peak, let's say, renewables are going to have to be in the market, therefore, they're going to have to be visible, controllable, dispatchable at some basis.

How will you do that? Now, it's one thing to envision being able to control a wind farm, it's completely another when we talk about rooftop photovoltaic. So the communications and control infrastructure to do that, and maybe to retrofit, become an issue, and how do you integrate storage with it?

So work on this and how should that be integrated with that building automation system? You know, if commercial buildings are getting rooftop photovoltaic in large scale, they ought to be dispatchable and you ought to use the existing computers in the building, if it's possible.

So there's a host of technology and market protocol issues here.

Okay, we mentioned green charging. Now, green charging leads to another real interesting question. The electric vehicles that these auto companies are going to bring out in 2010 are going to have more compute power, and more communications on them than an i-Phone.

In fact, I know one other company is saying, you know, we're really thinking about the car as an i-Phone with wheels, so why would you talk to it through the meter?

With apologies to the meter people in the room, why wouldn't they talk directly to the car? And the power electronics in the car already know how much power is coming in or out of that car for charging.

So the only question on the table is, is the -- are the power electronics on the car accurate enough for revenue quality?

And we've asked the auto companies that question and in all cases, so far, we've got a "what the hell are you talking about?" But they're thinking about it.

Because if you could put the meter on the car and the car's got GPS, and it's got wireless communications, you just solved a whole host of portable load kinds of questions, and you can move the settlements function back to some semi-centralized organization. This happens with cell phones. So metering the car is a real interesting question.

It creates an interesting policy alternative, too.

If you wanted to create an electric use incentive for vehicles, either for when they charge or for people that acquire them in the first place, you can't do it if the vehicle's behind the meter, you need to know the vehicle charging load.

So you can put the meter on the charging station and it looks like another utility meter, but then what happens when you drive the car somewhere else? If you put them on the car, these problems go away.

We heard yesterday about bidirectional flow. Now, in the course of doing this work one of the utility Smart Grid folks said this is noise in the process, it's not going to -- there won't be enough renewables to make it an issue. We heard, yesterday, some folks state a concern.

I think, if you think about a 10 megawatt feeder to a commercial, set of commercial loads, and they all put rooftop PV on, on a Sunday when the temperatures are moderate, bidirectional flow is not inconceivable, you could have two or three megawatts of production and next to no load, if the HVAC is turned down.

The automation systems, the programming of the protection, and the distribution planning and analysis systems aren't commercially there to make it easy for utilities to cope with this.

Micro-grids as pilots, yes, but to go look at every radio feeder and to say, okay, how do we change things, tough problem today.

And one of the interesting questions here is, in California, especially, most of the distribution circuits have digital protection today, so if there a software download, a development opportunity for Schweitzer and ABB here, as opposed to replace the equipment? Don't know, does that electronics have the capacity to deal with the bidirectional flow in terms of enough memory, basically.

Okay, mentioned building automation systems, interacting with pricing in a more sophisticated way.

The message is the same as with the car, there's a lot more smarts there, why not take advantage of it?

And I'll conclude with the most far out, if you were building an office building today, you would look at say, aside from the HVAC everything in this building runs off low-voltage DC. So why are we putting 120, 60 hertz in the walls, explain that again?

And every device that's got a charger, right, if those devices were semi-standardized, maybe we could just wire the place for low-voltage DC, or at least wire groups of rooms.

Sounds nutty, but a Senate Energy staff started asking about this question and I think was building somewhere into the Energy Efficiency R&D can we look at that, because if we're going to retrofit all the Federal buildings, we'll put in LED lightings, and they're all just office equipment and lighting, why would we then stay on the old paradigm?

And that's probably the one customer that could get the electronics industry to look up and think about changing it.

And I don't know, standing here, if it makes sense at all, but it's an analysis that ought to be done. When does it make sense to do these kinds of things?

So work in process, that's where we are. Give me your cards and I'll give you the matrices to fill out.

MR. GRAVELY: Any questions. From the audience here, any questions? Or Commissioner Byron, any questions?

COMMISSIONER BYRON: That was -- that was -- you've put a lot of thought into some of these ideas. I like this very much, I'd like to talk to you some more.

MR. MASIELLO: Well, thank this man.

MR. GRAVELY: So we're hoping to put some of those concepts into recommendations for the IEPR, that's the ultimate goal.

So for those of you who are here, again, the ultimate goal here in this white paper is to help us identify the opportunities and in some sense prioritize where we do those, in our case research, in other cases policy.

So you heard, yesterday, how important real migration is to California, so I would encourage you to get the business card and be part of this review process.

You will also see this later, in a draft form, but you'll have much more direct input now, before the paper is written, than when it's integrated into the IEPR report.

So any questions online, I'll see if the -- upstairs, anybody got a question we should talk to before we move to the next speaker?

MR. MASIELLO: I thought I was going to get to sit down.

MR. GRAVELY: Well, actually, we have 45 minutes in the afternoon for comments, so I'm going to run a little long each question, because we found out that we do get good questions now, but at 4:30 everybody bails out.

So, unfortunately, the last couple of speakers will be a little bit late. But we seem to get much better feedback, much better interaction if we allow people to talk while the presentation is being given. So we'll take a couple of questions and then we'll move to the next speaker.

Go ahead, Dave.

MR. HAWKINS: Yeah, Dave Hawkins, California ISO. One of the things that we discovered in the last few weeks is that the wind generation resources have no backup capability. So if the -- when we're trying to get transmission line outages, there's no auxiliary power at the sites.

And the concern is that if the wind is really blowing and they need to hit the brakes to stop these units, and the hydraulic system, and we take the transmission line out, there's no backup power to make sure the auxiliary or the hydraulic systems work.

So it occurs to us that energy storage might be at least a way of doing that.

As you were talking, it also occurred to me that if we've got a lot of PV and stuff where we do have bidirectional flow, what happens if the distribution circuit trips out and where's that power going to go, and is storage and/or some of these more sophisticated controls then a way, potentially, of handling the fact that customers on that circuit may be at 70 or 80 hertz versus 60 hertz.

MR. MASIELLO: You know, that one comment about the backup at the wind farms is right on the money, Dave. And in some of these island environments, the utilities are already insisting in the PPAs that the wind developers have ability to control the ramping and control the black start problems, et cetera, which translates very quickly to storage.

But again, you need standards that -- commercial standards that motivate the folks to do what's right.

MR. REINECCIUS: Stacey Reineccius, Powergetics. A quick question on this meter on the car idea, I understand the approach of trying to simplify it and keep the measurement with the actual storage component, that makes a lot of sense.

However, if you're talking about people moving from the residence, where they don't have, typically, any kind of demand rate charges and you take it to a business, where they do, it seems to me you'd still have the same metering problem that you had before, which is you now need to correlate the car with the location, and the demand, and the time of the demand at the business, which is where most people will be going and charging, or discharging. How do --

MR. MASIELLO: No, if the meter's in the car and the car has wireless communications, you drive it to work, you plug it in, right, and you could have purchased it from a supplier different than the supplier that your employer dealt with --

MR. REINECCIUS: Yeah, but you still have --

MR. MASIELLO: -- and the back office settlements would take care of that.

MR. REINECCIUS: Yeah, but you still have a very complicated reconciliation issue there if the --

MR. MASIELLO: Yeah, but the whole -- the entire cell phone business in North America runs a billion in settlements through one centralized operation, because it makes sense. And when you think about all the cell phone calls, and how bad it used to be when you paid per call, like with long distance, and they solved it; right, different tax regimes in different places.

MR. REINECCIUS: Yeah, but they do spend 50 percent of their infrastructural cost on their billing.

MR. MASIELLO: Well, that's -- go ahead.

MR. REINECCIUS: So it's not an inconsequential cost to consider.

MR. MASIELLO: Right.

MR. REINECCIUS: And I've spent 20 years in telecommunication.

MR. MASIELLO: Okay. On the other hand, a 300 or 600 dollar Smart Meter, as part of the charging station, is pretty expensive, too.

MR. REINECCIUS: Yeah. Thank you for the comments.

MR. MASIELLO: Okay.

MR. GRAVELY: One more question and we'll move on.

MR. ARTS: Thank you. Hector Arts (phonetic), from having consulting --

COMMISSIONER BYRON: Please speak right into the microphone so we'll be able to hear you.

MR. ARTS: The same subject, how do you know that the electrons that you're getting to your car are coming from a utility or from a solar panel that you have in your house?

MR. MASIELLO: How do you know that today?

MR. ARTS: That's the -- well, you --

MR. MASIELLO: The electrons are not green, orange, or brown.

MR. ARTS: Correct. So how would that meter in the car know what source is --

MR. MASIELLO: Oh, back to the green charging?

MR. ARTS: Yes.

MR. MASIELLO: The key point there would be if you said, look, I want my car charged between 7:00 at night and 6:00 a.m., there would be a mechanism for linking the charging rate of that car to some renewable resources that were under the control of the provider you signed up with. Okay. And you, as a consumer, would be getting not just the it's better for the grid, for you to defer the charging and it saves you a little money, you'd be getting the green linkage that says you're doing the right thing environmentally, that was the concept.

MR. ARTS: Right. I'm not sure that I asked the question correctly. My question is if I, as an owner of PV installation and potentially energy storage in my house, choose to charge my car from that independent source of electricity from the grid --

MR. MASIELLO: Right.

MR. ARTS: -- how --

MR. MASIELLO: Oh, you're saying with the meter on the car, the charge is coming from your battery; right?

MR. ARTS: Yes.

MR. MASIELLO: That's a good use case that I hadn't thought about. It would have to be worked out in the settlements with the actual meter, the utility meter on the house, too, or it could be handled in the protocol between the car and the electronics controlling the battery, right. So I think it's solvable, but it's a good question, it's a use case I hadn't thought about.

MR. ARTS: Thank you.

MR. MASIELLO: Good.

MR. GRAVELY: Thank you very much. Thank you. So appreciate all the questions and we'll move on.

One thing I will say that I've learned on the research side that has surprised me, we've had this same discussion at other meetings and I had to ask the utility why you care where the car is, and where it's charging, and they convinced me they do care and, in fact, they do want to do this.

And I think the cell phone analogy is very close.

But they have a desire to know where the car is and where it's being charged is, I guess, like roam charges. And so there is a lot of effort being done at PN&L, and certainly by SCE to look at maintaining the location of the car and where it's sitting and charging. It has to do with rate structure and it has to do with incentive, I guess.

But anyway, they have demonstrated to me, at least, that they have a desire to know where the car is and how it's being charged.

Okay, our next speaker will be from Sacramento State University, Dean Emir Macari. We've been working with them for about a year and half setting up some research efforts, and the ultimate goal for us, at the Commission, is to work with them and some of the utilities in Northern California to establish a Smart Grid Center, and so they are well on the way of doing that.

We haven't formalized that relationship with the CEC this year, but we anticipate doing it in the next fiscal year. Thank you.

Dr. Macari.

DR. MACARI: Thank you very much. This is a great opportunity because after looking at the agenda and the schedule for all the speakers, I see that perhaps I'm the only educator in the group.

And I want to start out by saying education is --

is what’s going to make the Smart Grid and energy efficiency possible.

I’m going to show you, I brought my props here; I took them off my meter. As you can see it’s circular, so it hooks onto the meter. You can walk around with this wireless device, SMUD, I’m in the SMUD territory.

I have my daughters, I have three daughters, I had them install it, help me install it, I had them work on it and I then walk around the house turning on and turning off different devices and seeing what the result is at the end, how much money them leaving the air conditioner on, the TV on, the fans on results in.

They’ll be surprised that they don’t have this device when they get home from school today because they’re learning already that it is important.

It’s not an issue of dollars that we’re spending; it’s an issue of conscience, and awareness of where we are and where we fit within the world.

I think as an educator I have exaggerated a little bit on how I have spoken to my daughters about education and the importance of it, but -- and I’ll tell you why, my 15-year-old daughter just told me three weeks ago that until a year ago she thought that she had to get her PhD before she got married. So education has been an integral part of our family. And I would hope that education would be an integral part of everybody’s family. Perhaps that exaggerated the way that we’ve done it in our home, but to make sure that the younger generation is able to adapt to what we’re doing.

This brick, if we were to have this in an amp on the i-Phone, or on the cell phones that my daughters carry around, it would be much more appealing. And eventually that’s where we’re going.

So, hopefully, education, research, and the involvement of the university will lead us there.

So thank you, Mike, for inviting me to speak today, I want to talk a little bit about the California Smart Grid Center that we have started at Sacramento State.

Where do we --

MR. GRAVELY: Shift the down arrow.

DR. MACARI: The arrow, okay. Either one of the arrows, okay.

So the mission of the University’s Smart Grid Center is really to be a ground where we can product test and all of the different devices, from automated metering infrastructure to all of the different sensors and devices that are going to be needed for the Smart Grid.

We want to be an unbiased proving ground. We don’t want to fully associate with any one of the vendors, but remain and keep our integrity in order to be able to provide the Commission and the State with a proving ground that you can depend on to see if the claims that are being laid out by the vendors really hold up, from anything regarding global climate change all the way to energy security.

Next, we want to make sure that we support the upgrades that are needed for the Smart Grid in order to bring it to California.

And next is develop California’s Smart Grid workforce, and I will add a diverse workforce that is needed for -- in order to get Smart Grid really moving forward.

Last night we had a nice event up at the Intel campus, at Folsom, right up here about 20 minutes up the road, in which we -- which we called the Energy Efficiency and Smart Grid, Capping Sacramento’s talents. We had over 220 people attending the event, anywhere from engineers to IT professionals, to venture capitalists, and people interested in knowing what this new revolution is about, and how can they be involved in it.

Peter Karpoff, thank you very much for being there. And actually, his comment from Department of Energy was that he was surprised to see the grass roots level of interest that is going on in California, that people don’t know in D.C. what is going on here, in California, and perhaps we need to open up the channel a little bit better.

So I asked Sajol Ghoshal, from Akros Silicon, to provide me a couple of the slides that he used. And, of course, we know what the Smart Grid is. We know that we have these traditional sources of energy. We know that we want to integrate the distributed resources of renewable energy, wind and residential solar. We know that we want to have the Smart devices. How and what can a university do to promote these areas?

In addition, we know that there's issues between should we use the protocols of the Smart Meters or should we use the power of the internet to integrate all of our devices?

So the question first is why California State University at Sacramento? And the answer is that I believe that we are the perfect choice to have this Smart Grid Center. And I will tell you a little bit about why I believe that we are the perfect choice.

I guess it sounds a little bit like a sales job, but from an academic, forgive me.

We have grid faculty members that have maintained a important program in power engineering. We are the -- the only program in the State of California that offers a master's in power engineering, and only one of two programs in the State of California that offers power engineering as a bachelor's degree.

The reason is that many universities, especially research universities, moved away from power engineering because it was a mature discipline; we weren't going to learn anything else from power engineering.

Micro-electronics was the sexy and most fundable area.

Well, Sacramento State remained as a big player in the area of power engineering and I think it was because of a mistake, or because of just simply happening. We had a lot of very good faculty members who are tenured, and we know that once you are tenured you can't leave, you can't be fired. So these faculty members remained interested in having power engineering as their discipline.

During the eighties and nineties this cost the university a lot of money to maintain the program, when there was classes of students only with two or three students. Right now we're seeing them with 40 -- 40 and 50 students, because people have learned that energy is the future and not necessarily the past. It is the present and the future.

So we have a group of professors and last night I asked -- we had this meeting up at Intel campus, like I said, and I asked people in the audience to raise their hand, how many folks had gone to the power engineering program at Sacramento State, and I think maybe about a tenth or twentieth of the people -- or 20 percent of the people raised their hands. That means that we have a lot of alums out there that have been working in this area and they recognize some of the names of our professors.

We have people in electrical engineering, power engineering. We have people in devices and sensors. We have people in computer security and networking, and we have people in renewable energy.

Just one example of one of our professors, Professor Turan Gonen, his books have been used all over the world in power engineering, power distribution systems, and it may be trivial to say that, but no students graduating out of UC or Stanford, or USC really receive major education in power engineering. And I'm very proud to say that we continue to do that. Again, I think it was an accident. But many great discoveries in our world have been accidents. So that's why I'm pushing it.

I've been only -- I've been the Dean of the College of Engineering only for three years. And I said, okay, what are our niches, and I started to explore them. So we've been talking about Smart Grid for about two and a half years, way before President Obama started talking about it.

In addition to a power engineering program, when I came onto campus faculty groups asked me if I would be supportive in a proposal that we would be submitting to the Department of Homeland Security and the National Security

Agency to have a center for information, assurance and security, cyber security. And I said absolutely, let's do it.

Then I started Googling and figuring out that it takes about three or four tries to get it in. UCLA, it took them two years, denied the first time, denied the second time, they got it the third time.

Stanford, they were denied the first time and they got it the second time.

So I told them, okay, well fine, let's go for it, but I don't have high hopes. Lo and behold, we were approved on our first try because we had the right people in the right place.

So right now we are starting -- actually, today and tomorrow we are teaching an academy on Smart Grid to most agencies in the State, and to people all over the State that are interested in security assurance and cyber security.

As it turns out, that is a major issue of importance to Smart Grid, so we have incorporated this center into our Smart Grid Center.

When I started coming in and looking at, okay, so what are the courses that we can offer people in order to educate the next generation of Smart Grid leaders, and I started looking at it and we have an array of wonderful programs and we have developed, now, a certificate of any one of our students, and people that already have a degree, they can come in and take a combination of courses, from electrical engineering, power systems, all the way to introduction to future power and systems, and Smart Grid, moving on to solar engineering, as well as cyber security, look at that one of counter attacks, and computer attacks and counter measures.

We expose our students to try to address how hackers may be able to come into our grid. How would they come in and how can we prevent that from happening, it's a very important part of the Smart Grid.

So the Smart Grid Center, this is a few pictures of our campus. I don't know, I don't have a pointer here, but on the right lower --

MR. GRAVELY: Use the arrow there.

DR. MACARI: Okay, very good. This is our campus; this is the American River coming through, beautiful campus. Right about right here we see this bridge right here, which is the Guy West Tower Bridge, is the small replica of the Golden Gate.

Right in this corner we see the Smart Grid Center, this Center right here, which is across the street from our engineering building.

Our hope is to be able to provide the support, along with the utilities, and right now we are partnering strong, very well with SMUD to provide support for Net Zero Energy homes by 2020.

We hope to have, on our campus, a demonstration project that will allow students from every age to come in and see what is Smart Grid building as, what a Smart Grid home is all about, in order for them to be able to visualize what they were involved in the future.

Our students, working with the Power Engineering Society, a very strong society, we provide a lot of scholarships, bringing people from industry.

And here, the last two years of their posters that they put together, you see a lot of different workshops and seminars, where people from industry come and talk to our students. And I would welcome anybody in the audience, as well as in the cyber audience, to send the information if you want to speak to our students and help us in this program.

In addition to that we are hosting, at Sacramento State, the Clean Start and Clean Technology Programs. We are working with everybody in the region. So we're not just an isolated ivory tower type of academic institution. We work with industry, we work with entrepreneurs, we work with venture capitalists.

And on October 16th we will be hosting the third Clean Start Showcase. That is just to show how Sacramento is positioning itself as the Clean Start, and perhaps the Smart Grid, hub for the country.

Our power engineer laboratories -- I'm sorry, in the translation from 2003 to 2007 Power Point I think there's some problems there.

But our laboratories are the type of laboratories that you would see in a substation. We have high voltage coming in. Our students are used to working with high voltage, but we are now integrating them as well to the digital areas, in order to be able to control and be able to work with power in a -- from a computer type of platform.

Most importantly, we are developing a diverse and talented green engineering workforce.

If you come to our graduation, which will be here next week, on Friday, at the Arco Arena, and at the time that President Alex Gonzalez asks all of you graduating, that are the first person in your family to go to college, please stand up, you will see a third of our students standing up. We are changing generations and our students are very much involved in helping change the trends in California. That's one thing I'm really proud of since coming to Sacramento State.

These are just some examples of the type of research projects that our undergraduate students are working on for an entire year.

We have a solar energy collector, it is a dish generator, it can generate power. I’ve seen it, I’ve seen it generate the power, I’ve seen it power different devices.

This is a project that we sent up to Central America, in Panama, in order to be able to help people in rural areas, that are away from the grid, and this is part of our Engineers Without Borders Program chapter, in which solar energy, and we provide them with the tools that they will be able to provide, to bring sufficient power to their pumps in order to pump water up to the village.

Finally, another example, this one was in the mall, in “The Mall” as I tell my daughters, in Washington, D.C., not the shopping malls that they go to.

This was a project, we were trying to see the applications of a vertical type wind turbine in a horizontal position, to see if this is sufficient reliably and sufficiently powerful to warrant installation.

So as I finish, I would like to go back to Governor Schwarzenegger’s, just a small, little quote out of his speech to the United Nations, in which he spoke about California, because of its unique position, and its cutting edge of what is to come, “what we are doing is changing dynamic and preparing the way and encouraging the future.”

So my question is can we help create the Smart Grid, can we help develop future generations of engineers and scientists who will help us combat global warming? And I submit to you that the answer is yes, we can, down below there, “si su puede.”

And, hopefully, our university can help promote what the California Energy Commission and the Governor’s agenda is relating to Smart Grid.

Thank you very much for your attention.

MR. GRAVELY: Thank you. Richard, do you want to do it now or after lunch, your choice?

We’re running about 15 -- yeah, we’re running about 15 behind. We can break for lunch now and come back in an hour, or we can have Richard tell us a little bit about international things.

DR. MACARI: If he’s got a picture of President Obama shaking his hand, we can do it now. If not, after lunch.

MR. SCHOMBERG: No.

MR. GRAVELY: So why don’t we -- one thing I will add, I appreciate Emir giving us a little bit of the background, but also he showed a couple charts I thought he was going to point out, they are doing some projects.

And one of the projects that they are partnering with UC on is developing a protocol for a reference design for a gateway on the home area network.

One of the things we’re running into is the -- as you've heard before, and you heard during our standards session, the home area is an area where there's a huge lot of proliferation. So we're looking at following some of our previous success and developing a reference design for a device that would be used with multiple sources in and out, and the first cut of that will be done with a combination of UC Berkeley and Sac State, and demonstrated there at Sac State, as well as Berkeley.

So we are -- we do -- we are off and running on some of the actual technologies, we're doing that.

Another area that we're looking at is in the area of power electronics and that the utilities are having a challenge at the -- if you saw pictures of those homes, where you have different size houses next to next, and what's happening is some of the transformers that support those homes aren't necessarily sized for the challenges they're having.

So we're actually having this university work again, Berkeley and Sac State are working to model that environment, those transformers that handle eight to ten homes, and try and better understand the interaction of the inverters and the interaction with the transformers when you have solar on the roof, and how that we can go forward.

So the first step is can we duplicate the challenges they're having and second of all can we make recommendations to fix that. So they're looking right now to develop a computer model to help us understand that.

So rather than put Richard on the point, I think of having lunch, we'll start back with his after lunch. Why don't we break for an hour and we'll come back, if we can, at 1:15, instead of 1:30, and then we'll start.

Again, let's see, in the afternoon we have about an hour for questions and so we'll compress and have the questions during the presentations. We may go a little later, but we don't anticipate a 45 minute question/answer session at the end of the day.

So thank you very much and we'll come back at 1:15.

(Whereupon, at 12:14 p.m., the Workshop
was adjourned, to reconvene at 1:15 p.m.
this same day.)

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AFTERNOON SESSION

1:22 p.m.

MR. GRAVELY: Now, from Electricite de France, Richard Schomberg is going to give us the international perspective.

And then we will hear from San Diego, Southern California Edison, and PG&E, and then we'll take a short break and hear back from industry, from that perspective.

So we'll do our best to stay close. Like I say, we do have 45 minutes planned for the end-of-the-day discussion, so I think we'll probably even it out just a little bit.

And I think we got most people back, seated down. And there's a line -- it works out best, if you have questions that you type those questions in and then we'll have someone bring those up to the podium to be asked, from that perspective.

So welcome everybody back, everybody settle down. So we'll hear a little bit now about the international perspective on Smart Grid, from Richard Schomberg, from EDF. Richard.

MR. SCHOMBERG: Thank you. I will today actually share a couple of ideas about what is going on involving Smart Grids about the world, and this will be daunting because in 20 minutes to go around the world will not be easy. So I will be -- I will actually combine maybe the general ideas in different part of the world, and then dive -- I'm going to dive in Europe and I'm going to dive in Japan.

So first, first thing you see, there are very different drivers across the world, and working with the many different groups you realize what's the diversity, diversity of constrain, diversity of regulatory environment, and diversity of business objectives.

But no doubt that the same solutions actually can apply and there is no doubt that there is a world market for solutions.

So what I'm going to do is I'm going to make a couple of comments on this slide, where we can see a different part of the world, then I'm going to dive in Europe. I'm going to dive, actually, in Japan because for a long time we didn't hear much from Japan, and very recently I was very surprised to discover all of the sudden that they have a theme park, a Smart Grid.

And at the end of the presentation I want to update you that is going on in the international standards arena regarding Smart Grid.

So first, okay, in the U.S., well, you know what's going on, definitely.

In Europe -- in Europe the drivers have been for a long time the penetration of distributed generation and renewables. Okay. It has not been much the reliability, because the European utilities have been able to invest a lot and the infrastructures are rather in good shape.

But we start to experience new issues, which is that the infrastructures are aging. And the problem is if you want to keep the quality of service you need to do something. And that’s an issue that we’re discussing with the regulators, that’s an issue where they say, hey, it works so why would you, utility, put more money in the infrastructure. We have a very -- we have a very hard time explaining that if we don’t do it, the quality of service is going to drop dramatically.

And also, rather, the generation mix in Europe is quite different, and I will give examples and diving into, actually, the example of what’s going on in France.

Now, if you go to Korea, Korea is a very active, very, very active, they have such a growth that they are still actually building, furiously, a lot of new infrastructures.

And also they have a huge appetite for information technologies. So they have major efforts going on, they are getting organized, and they have major efforts on national road mapping for Smart Grid, actually.

Now, in China, in China they don't just equate Smart Grid, they want to work on a strong and Smart Grid. You see, their idea is that they have such needs and at such a level today that they are building aggressively huge transmission lines. They succeeded to develop ultra-voltage AC lines, maybe that's the largest -- those are the largest projects that have been going on for some time.

And they started to develop 10 gigawatt of wind, and this is where the strong and Smart Grid comes in because, of course, there is the intermittency of wind. And they are getting more and more active in the Smart Grid arena.

Now, if we go to Japan and I will dive into Japan specifically. You see, for a long, long time in Japan we have such a large industrial groups that they seem not to have experienced an integration problem, because when they want to do something, well, just one company's going to do everything. So there is no integration or interoperability issue.

But I will show you some examples of what means Smart Grid to them, because there is a specific kind of issues that they are addressing there.

So let's actually dive in France. And actually, I use France as an example. So from Europe there are many commonalities.

So typically, you see in Europe we are working on that three-leg stool you see, base generation and for some power fuel-up it's highly nuclear.

And we, you see, energy efficiency is at the top here, it's really an energy efficiency and connecting the consumers.

Now, I'm going to dive in this, and were are developing aggressively renewable energies. And typically, ideally, a lot of countries or utilities in Europe, we like to say we want to deliver as much as possible renewable energy and then if it's not enough, we're going to complete this by some nuclear energy.

So if we look at, well, the base, and I want just to show one slide on nuclear because there is a reality here. For example, my company is investing in ten nuclear reactors and that will be in operation by 2020, that's around the world. There are 20 reactors currently in construction, and 17 will be commissioned by 2011. And France, we're building one in the second one, UK is building four. The first one will be in line in 2017 and the French one will be online 2012, and while we do some in China.

But maybe most of interest here is that we are building for here, in the U.S., and the first one will be online in 2015.

So you may say it doesn't have anything to do with

Smart Grid. Well, we see that Smart Grid is actually the connection of everything that Commissioner Chong reminded yesterday, there is the climate change, the RPS, the loading order, and the solar initiative, so actually everything connects to one point.

And when I said on the triangle we work a lot on energy efficiency and connecting the consumers, definitely there is a huge effort put on heat pumps and there are new products, new ideas that has been mentioned yesterday, also. There is a lot of hope on heat pumps and, of course, on building, including the buildings.

But what we do a lot is working with usage that has not been using electricity up to now, to have them switching to electricity, typically industrial use, or some heating in a lot of houses. And, of course, a very huge hope that the PHEV will have a major impact on climate change, so there is a huge effort there where -- well, depending the country you are, and depending on your energy mix, how you generate the electricity, you can see the affect on this graphic on CO2 emissions, it can have a dramatic effect.

And we have been developing, EF has been developing, actually, a charging station that is very, very cheap, to make sure that as a utility we can progressively deploy this at the lowest cost, and this is being done with a partnership with Toyota where we have a fleet of hundred

PHEV that is operating and tested in France, in one area of France.

And, of course, connecting the consumer so even if they don’t see anything knew here, except that typically we do have -- well, we do have in the way of work, a lot of work on AMI. But have also enough in the regulated business, the regulated side of the business. But we have a lot of things going on, on the deregulated side.

And the communication to the home, you see can definitely be through the meter, but there can be some communication, also, directly to the home. And that’s precisely what I heard this morning where there was this open question.

So we are still working on this. I don’t know why it’s not moving. Okay. And so that might be of interest.

So typically here there is a Chinese wall in between regulated operations and the metering, and the deregulated business where there are 26 competitors in France to sell the retail electricity to customers.

So on the regulated side this is the new meter that we just developed and I would compare its intelligence to what California has been doing and leading, and we’re going to deploy 35 million of this.

And see something intriguing here there is a USB port actually on the meter. And that meter can communicate through PLC, the utility, but it can communicate within the home through actually devices that can be plugged here on that USB port. That's for the technology part.

Now, if we go to the unregulated side of the business, you see on the table here that kind of ladder, it's a gateway that we can provide for a subscription fee and we provide services, actually, to customers there.

And there is a lot of work going on here that we deploy tens of hundreds of thousands a year of that type of product. And we are still working on this and cooking new offers.

There is a lot of activity, especially because EDF group is across Europe, with UK, Germany, France, Italy, where other models and other technologies have been tested, where if I had more time I could actually present those technologies.

Finally, the Smart Grid, what for? Well, what for, I alluded to that yesterday. You see, of course, you need to observe and control better. But if you bring in some intelligence, more if you have large databases, or even artificial intelligence, as there was a question from Rachelle Chong yesterday, therein you can start to really optimize. And I think there are no limits.

Whatever projects we have seen today have been really addressing observing more, controlling more. Okay.

But this is where I think there will be huge amount of innovations and value derived, and even the real value we're going to find it that anything that help anticipating.

So those are a list of a couple of projects going on within EDF to address those challenges. And I'm not going to describe in detail this chart because it's just to show that -- so I mentioned what we're doing on meters and energy boxes, but within the distribution company there is a huge project to actually interconnect more all of the equipment with more intelligence in there, and make it possible to work and operate virtual park -- you see, that we'll be able, actually, to aggregate somehow locally the distributed generation.

And also we work a lot on everything that will help detecting the faults in the network and restore the network as quickly as possible.

So now if I climb one step, let's go to the European level, I just want to remind that there is a European Union Research Program that has allocated almost $4 billion for research on Smart Grids. And if I show this slide it's just to highlight the idea that you see the money is essentially, the effort is essentially on contrary strategies and simulations that state estimation. So it's really on those layers of intelligence here.

Of course we have concerns about interconnecting the different electric systems from the different countries but here, again, it's a matter of simulation and modeling and simulating.

And cost-gathering issues, we're supplying storage of course. But the grid asset management, you see, it's right on what I started to explain, which is even if you had a good grid, as we thought we had in Europe, where it's aging, and actually you need to put in place optimization of the asset management and get prepared, actually, even to refurbish and make sure that you don't lose the quality that you might have got to some point.

Now, I am diving into Japan. I don't have many minutes left, but you see now I'm using slides from a colleague from Japan. I was amazing to see this is how they picture the purpose of Smart Grid comparing the U.S., European Union and Japan, and I think they -- we are quite in agreement.

But what's interesting is that that's the first Japanese theme park in Smart Grid that I see, you see. All across the country they have going on some demonstration projects, whether it's connecting the cost of PV with storage, or actually stabilizing wind power, or also having projects with regimented power grid, or micro-grids with various new energies, and I'm going to really go real quick across this just to give a flavor of what's going on.

So the first is a demonstration of PV, where for each home, you see, there is a cabinet with four KVA storage. It’s lead acid, you see, it’s really a basic technology, but it’s been installed, and it’s monitored, and it’s a very interesting test bed, actually, to figure out the real value to have this and maybe then work more on all the technology to get a cheaper technology to do this.

Another application is stabilizing the wind, you see that’s a 13-megawatt wind farm with 20 turbines, and they have the actuates of VRB battery.

But what’s interesting is that with a battery, with a storage device, which is 20 percent of the nameplate of the wind turbines, actually they allow much, much more dispatchability. And the interest of such a test bed is not to show that the battery storage work, it’s to find out what are the proper -- what is the proper ratio of storage to nameplate to find out why you can improve availability. And availability instead of being 25, 30, or 35 percent is much more kind of 80 percent with just 20 percent of storage.

And this one I cannot resist to show this one. I’m sure you’ve seen -- you might have seen that, but they start to assemble it as if it’s a theme park in Japan, even though it’s not in the same city, where this one, what it is, you see, they’ve been working on a micro-grid which is completely independent from the utility grid, except there is one tie. There is just one tie here, just under this, to the utility. And what it is, here that's the generation, you see, that's a gas -- gas engine using biomass, you have a battery, you have some PV and you have buildings that might have also some PV and some wind turbines on them.

And the blue line is a -- something like four miles, a private line running across the buildings, and it's an autonomous 600 kilowatt system. Of course they do that with school, with a CTO, so I guess maybe it's easier or the customers are not too picky.

But it's a very interesting demonstration by the variety of generation. And I think it's a very good example of how Japan is thinking about Smart Grid. You see, it's a highly seismic country, so they work a lot on whatever might allow them to survive, even if there was a major earthquake, what infrastructures would be lost, that they can have multiple pockets that can actually survive.

And then the PHEV idea, using the PHEV as a battery is also the idea is developed in the same spirit.

So there is another example, I don't want to spend time on it, but which is working on 12 buildings here. And what's the lesson is that it's just that they don't work just on electricity, you see, they work at the same time on all the fluid, electricity, cold water, and steam. And this is how they approach the Smart Grid. So it's really by pockets, by different micro-grids and it's also thinking the entire energy equation whenever it's possible.

Now, yesterday there were several questions about and what about system engineering or an approach from specification requirements due to the design, so that I wanted to share that across the world we can see that most of the project actually adopted something that has been developed here in California, which is the approach to use cases and the requirement derived from the use cases that allows to then do a design in proper and optimized conditions.

And if you don't do that actually you screw up large and complex projects. But it's simple to say, but what of people that don't understand that until they start to do it on their fingers.

So just to mention this, this is agreed. And I want to finish on an update regarding what is going on at the international level for standards.

The IEC is a world standard organization based in Geneva, developing standards on everything electrical. And IEC has just organized a Smart Grid strategic group. Actually, IEC is composed of very many technical committees that have been developing standards across the board for everything.

And the point is that when you have a Smart Grid project, you have to go pick and choose in different communities different piece of standards.

But that's not the worst. The worst is that those communities are all -- they could be developing new things and it's going on and it's going on fast.

So definitely it's my -- it will be more an issue for the industry, rather than bringing some help, because those groups are quite productive.

So IEC has put in place the strategic group, I've been appointed to lead this group, and we had our first meeting end of April, in Paris, that was hosted, graciously, by EDF, and we have 13 nations which were represented there.

We identified 19 technical committees within IEC that are, I would say, somehow independently developing standards. But those 19 entities are developing standards related to Smart Grid. We identified a list of almost 30 standards coming from those 19 committees.

So what we decided is first to issue a short list of the identified so-called Smart Grid standards. It's a framework version one, it's ready, and we're going to open up a window on the IEC website so that actually anyone who is working on Smart Grid can, through that window, navigate and know what's going on. And that's ready to use standards, with the known limitations, which means that IEC will add also explanations on how to use those standards jointly with the known limitations today.

And this will allow to buy a bit of time so that we can work with the management of each of those 19 entities, so that they can obey the existing standards and direct design of new standards toward the same goal, so that Smart Grid projects can use an entire suite of IEC standards.

So that's very fresh information. There's going to be a press release that we did this morning that we're going to come out tomorrow. And came out, also, from this workshop a white paper and a short list, and I would be happy to circulate or give it to anyone who is interested.

And I hope I did not blow up the time. Thank you.

MR. GRAVELY: We have one more utility speaker here, I think. Go ahead and sit up here, Paul.

So since we have, again, for the utility speakers we may, in the interest of the afternoon, go ahead and have the three of them speak and then some of the questions may be pretty much across utilities, so we'll have the panel have a chance to actually answer questions, if that's okay.

So the next speaker will be from San Diego, Tom Bialek will share with us some of the Smart Grid activities in San Diego.

So for the speakers, if you will give a little extra time at the end, we'll have a chance for the panel to address the group in whole.

Okay, Tom. Thank you.

MR. BIALEK: Yes. Well, hopefully, I'll try to keep you all awake; I know it's somewhat difficult after lunch.

What I want to talk to you about is what we've been doing at SDG&E around the area of Smart Grid. We've been doing a lot of visioning work, roadmap work, a lot of activities around projects, upgrading foundational IT systems, and we're looking at R&D to try to move the Smart Green Grid concept forward.

Why do we say Smart Green Grid? Well, clearly, if you've been paying attention at all you realize that we have within the State significant RPS requirements. We see customers installing photovoltaics, we see opportunity for storage, large wind. We think that ultimately that is certainly within California, as well as across the U.S. that's the general trend.

So what we did do, we did spend some time working on a -- developing a vision of -- for a utility, where we think, you know, what a Smart Green Grid does.

And I think when you read it, Smart Green Grid will provide economic -- environmental and economic benefits by transforming the energy value chain via involving energy and information network that is resilient, open and dynamic, enabling the active participation of customers, utilities and suppliers in energy usage and supply decisions.

So I think you’ve heard a lot of this already. I think one of the things that -- we talk about transformation of the energy value chain. We see that as being all-encompassing. We also see that when you start thinking of this, does the grid really mean just the electric grid in the long term?

I think we’ve heard people talk about water, certainly the gas industry, it’s really sort of a broader, more encompassing vision.

So one of the things that we have done at SDG&E is we did spend some time looking at developing a roadmap, looking at how we, as SDG&E would move our vision forward.

We looked at, as you can see here, three time frames, which is really today, the sort of the three to five years, and then the 2020 perspective.

So looking -- we looked at the point of view of the utilities, customers, regulators and third parties across really the key characteristics of DOE, modern grid initiative characteristics of a Smart Grid, and we looked at what does that really mean. And later we’ll talk of that, what exactly are the energy policy goals of the State and, given the energy policy goals of the State from these various perspectives and these various characteristics of the grid, what exactly are some of the actions that SDG&E

would be taking or need to take?

So what you see here on top is the energy policy goals and you can see the timelines associated with them. And the way we have, again, sort of the near term, medium term, and then longer term sort of vision of activities.

In the near term, we'll talk a little bit more about these, but we're currently doing the deployment of base technologies, base foundational systems.

One of the things that you see on here, micro-grid pilots that we have, those are really taking and trying to leverage all the technologies that we are putting in place, plus looking at the future Smart Grid vision and looking at alternative service delivery models to customers, what can we do to try to provide better, higher levels of reliability.

But also look at incorporating demand response, incorporating storage, both from a customer side perspective as well as a utility side perspective, looking at fundamentally changing the perspective of the view of the customer from customers as being someone we serve to customers as being resources, so looking at that.

We're currently, obviously, and you'll hear this from all the utilities where, again, there's offering new programs. Pricing is a key to enabling demand response, a key to enabling some of these other programs, energy efficiency, demand response, home energy network, energy management.

I think what we're also doing is we're looking at installing some of the initial Smart Grid components. We have installed some software grid technologies, I'll talk a little bit more about those, micro-grid technologies, and then looking at PHEV or PEV infrastructure pilots.

If you go out in the little medium term, you'll see that we're now talking about automated auto-detection restoration and customer notification. This is building on, ultimately building on the foundational IT systems and system upgrades that are going on.

So we're expanding SCADA and line devices. At SGD&E we have been installing SCADA devices in substations since the early eighties, out in the field since the mid-, early-nineties.

We have -- you know, people talk about the system designs and topologies. Obviously, the transmission system's a network system. We have no, fundamentally no network on the distribution system. We are a radio open link design, with a one-and-a-half switch on SCADA.

What that really means is we've got SCADA at the circuit breaker and the substation, and we have a store in the middle of the circuit nominally, in the middle of the load, which is also on SCADA, and then we have an open tie switch, and that switch is also on SCADA. So it's connected to a different circuit, so a lot of the one-and-a-half switch design.

When we look at expanding these, we're looking at expanding these to try to take advantage of some of the new technologies that are available to us, as well as expanding what these systems can do, leveraging data and information, bringing that data information back to our -- what will be our new MSDMS system to provide better font location, better notification to customers, and automatic switching of our grid.

So then we also in sort of the mid, the near term, the traditional utility relationship is changing due to one or two new services for customers, load control demand response, bundled services.

So we thought in this time frame what we're gong to start to see with proliferation of PEV and perhaps home energy storage, that maybe some of the services, customers may want something different from the utility than what they currently to today. Maybe they only want us as a backup and we're going to provide that backup service and they provide all their own power.

Don't know, but we think certainly in this time frame those kinds of concepts, those kinds of ideas will be out there, people will be looking at doing that.

And then DR aggregation, including hybrid electric vehicles. One of the things when you think about the AB 32, and the AB 32 by 2020, one of the things this does bring up, clearly there's policy issues around how are we going to do that? But we need to start and clearly transportation is a big issue. Reducing the amount of emissions from vehicles becomes key to meeting those goals and we think in this time frame clearly there's going to be a need to start moving some of those activities forward.

And when we say aggregation, we're basically saying aggregation whether that be from a utility perspective or perhaps a third-party service provider.

What we also think really does need to happen in this sort of time frame is just the whole concept of major regulatory issues are solved, the whole concept of data ownership and services.

Today we, the utility, owns the data and are we willing to share? You know, it's a tough sell for us, we actually look at that and say, you know, it's on our books, it's something that's seen as a value to the utility. We have privacy issues associated with providing that level of information to third parties, customers entrust us with that information.

But we certainly that that is with Google, and Microsoft and other parties that this is clearly an issue that’s going to come up, and that at some point in that time frame hopefully the issue will be resolved, or at least steps will be taken to resolve that.

We’ve heard a lot about some of the cross-jurisdictional conflicts. Smart Grid is really an end to end solution, so if you think of a third party who’s going to aggregate demand response and sell them to the ISO market.

Here you’ve got a distribution connected load that’s somebody’s going to offer marketing services to, that now has to go to the ISO and offer a demand response vehicle that the ISO will use as a regulation service. So you Now -- you’ve crossed quite a bit an amount of boundaries, it’s really not clear how exactly that’s going to play out.

You can see, for example, in the FERCs proposed policy decision, the CPUC’s actual response to that proposed policy decision, where they’re sort of raising the flag to the commissioners of the CPUC that, you know, there are these issues, they’re coming and you need to resolve them. And, yeah, the CPUC sees this as something that’s under their ownership, it’s a distribution system, therefore, and so it’s going to be really quite interesting to see how this all plays out.

And then to the renewable strategy, I think everybody knows that it’s, you know, we’re looking at both bulk and local renewables. When you talk about bulk, you're talking about various locations that may not exactly be located next to the load centers, the wind doesn't necessarily blow. It does at my house but, you know, where do you really want to site all these big wind farms? Usually, they're out for us in the East County, or in Baja, in Baja, California. How are you going to get that power back to the load centers?

And clearly, if you figure a transmission solution to do that, clearly, you know, as we have seen with our sunrise proceeding, we're still not done yet and it's been five years since our initial application, and we expect that by 2012 we'll have it installed.

But if you're going to start meeting some of these policy goals in a timely fashion then, clearly, you perhaps have to do something very different than what we're doing today in order to expedite siting, expedite permits, and to really try to look at some of the -- you know, I'm going to talk about this a little bit later, some of the other environmental issues and customer issues around siting these facilities.

Now, when you go out in time, we're now saying by basically the time frame of 2016 to 2020, that really the customer side, supply side, the storage decisions become the norm, as opposed to where they are today.

Significant DR penetration, additional micro-grids where cost effective, and that's very deliberate because if you look at what we have to do to actually ion the customer, ion the system, the technologies we have to put into place really does raise the cost associated with providing that level of service and are people willing to pay for that service.

And then again, really at that point in time we're looking at it and saying, you know, really, this is customers as resources, that's where the vision goes.

PHEV adoption rises; utility becomes the gas station of the future. If we assume that we're going to hit these kind of AB 32 requirements clearly there's going to be, you know, what people have already talked about, more electric vehicles, a lot of them in California, a lot of them will be in San Diego, as well as other parts of the State. And so how are we going to deal with that, the infrastructure that we're going to need to accommodate that?

How -- not just the sending signals to -- sending signals, but the physical infrastructure of I'm going to drive my vehicle to work and I need to plug it in somewhere if I've drained it or almost drained it in order to be able to drive back, how are we going to take care of that.

And, you know, clearly, maybe all this will happen faster than that but, yeah, the rates in place, charge and discharge.

And then lastly, sort of advanced grid technologies in place, conditions-based maintenance become the norm as opposed to the exception.

Diagnostics, I think Richard talked about the aging infrastructures issues. I think all the three areas in California are pretty unanimous that we have a problem, that problem is underground cable. We need to resolve that problem, it's getting old. There's a lot of it in the ground, it needs to be fixed.

Diagnostics that actually can -- that can be put in place and actually take measurements online, in service, we believe that in this time frame those types of technologies will exist and it will be helpful.

And then ultimately, the incorporation of advanced energy storage to supply RPS goals, and I can't even read the last one.

So here's where SDG&E, some of the energy utilities, and it includes a utilities meter, because we're talking about a Smart Meter for gas, as well.

So these are the projects that are currently in place today at SDG&E and SOCAL Gas.

So we have our micro-grid projects, both the DOE funded and the CC funded projects going out in the 2011 time frame. We have, as does SCE and PG&E, solar initiatives in front of the Commission today, and that we expect to wait for five years.

Our stable communities program we look at, that’s something we’ve had in place since our 2004 cost of service filing, where it’s customer -- on customer’s facilities we’re owning affordable tanks or other forms of generation. They’re also doing, looking for lead certification, sustainable -- basically, sustainable environments, sustainable buildings, sustainable environment for work places at this particular point in time.

Self-healing grid pilots, talked about that. Well, we currently have seven circuits that we have enabled with automated switching technologies, both a decentralized approach, as well as centralized approach, so we are exploring both of those options.

And it’s kind of interesting because people talk about the complexity and here’s a good example for us, where we have seen pretty quickly that once you start trying to centralize IT functions, centralize decision making, things get complicated really quick.

Plug-in hybrid electric vehicle integration, I work a lot in that area. Grid communications and I’ll talk a little bit about that a little more, a little bit later here.

Enhanced outage and distribution management, so this is part of these 2020 projects where we’re installing state of the art, obviously, management distribution management system. That’s going to take the unplugged data from AMI, it’s going to leverage that to help try and locate faults, coupled with some other applications of fault locating, and restore service to customers, send crews to the right place, at the right time, and with the right equipment, reduce the outage duration that a customer sees.

Smart Substations, so this is where the commission-based maintenance roll out.

A new GIS, we’ve had an electric GIS in place for many years at SDG&E, but we’re now upgrading to a true, geospatial system, geographic information system.

Asset investment, try to look at, I think as Richard pointed out, the whole idea of optimizing assets and optimizing a asset performance. So we’ve invested in a tool to allow us to try to maximize our capital investments.

Customer enhancements, I think one of the -- people always sort of think that the utilities really, really know that you have an outage. Well, we’ve got SCADA on the system and I have a circuit that’s having an outage, yeah, we’ll know. But we don’t necessarily have SCADA everywhere today. And certainly behind some branches of our circuits we may not know at all.

And it’s kind of interesting because we rely -- at that point in time we rely upon customers who actually call in, and based upon those calls we are able to determine where their outage is and what type of outage it is as well. But it’s kind of interesting that customers will get outages late at night, two o’clock in the morning, and it’s amazing how many customers still phone in, it’s pretty amazing.

Mobile field force deployment, services, mobile data terminals to all customers -- or all customers -- all crews. We’ve had a lot of that already in place for Southern Gas and Electric, but that’s also going to apply to SOCAL Gas.

Smart Metering, you’ve seen the initiatives. And then, like I said, Smart Metering and Gas, which is basically an application presently in front of the Commission.

So where are we going a little bit here? Everybody’s talked about the Stimulus Funds, Stimulus strategy, so clearly we’ve got three strategic directions around the grid customer environment.

On the grid side, things like large scale energy storage, phasor measurement units, self-healing grids, network communications.

Customer piece, in-home and in-premise displays, control of appliances, energy management systems/controllers.

PHEV integration, renewable strategy, those are other areas.

So just really briefly, we have another program in place that we are just going to start, which will replace all of our legacy network communication systems. We've got lots of silos, so this is another project that's going on.

Here's a very brief, just going to look at a fixed mobile overlay, a Smart Grid layer, HotZone with Wi-Fi, Wi-MAX and also support emergency management.

And last, but very briefly, lots of people talk about storage, lots of people talk about renewables, integrating renewables, talk about things that have to happen, the need for R&D regarding mitigated intermittency, impact and design of storage systems and associated controls, and system modeling.

The need for renewables strategy, the NIMBY and BANANA issues, so NIMBY I think of -- that is and BANANA'S been nothing near anyone.

And then the need for a cost allocation strategy, who pays, who pays for the storage that would be potentially associated with bringing it in the mitigating the intermittency? Is it going to be on the developer or is it going to be a socialized cost?

And so with that, I will stop.

MR. GOMEZ: Thank you, Tom.

Okay, our next speaker is Paul DeMartini. Pardon, what's that? You're a lifesaver, thank you. Okay.

MR. DE MARTINI: Thank you. Well, good afternoon and thank you for the opportunity to join you again, to show a little bit more about what we're doing at Southern California Edison on Smart Grid development.

To start, the basic concept that we have, which is not really much different than what you've heard over the last day and a half is that we do see this really, ultimately driving towards a clean energy future and that's really the grounding point for what we're focused on from a Smart Grid perspective.

Within that we think that innovation of both energy and information technologies will deliver these environmental benefits and customer values, so we don't lose sight of the fact that we definitely have to have demonstrable customer value as we put this forward, and that we really do think that's there's energy technology break, there's not just storage, but others, that will help us to achieve this, in addition to the information technologies that will be a part of it.

These four areas are pretty basic, it's what we've all talked about in terms of renewables and the need for increasingly more, and not only at centralized, but decentralized. Which means that how we deliver this power is increasingly important in terms of thinking about what needs to be done differently and what new technologies need to be integrated to be able to support that.

Actually, Smart Metering provides not just the capability of all the things that we've talked about and advocated for the last several years, but other ways to leverage that infrastructure, which I'll touch on, to create additional benefits that weren't necessarily in our original business cases, but are thing that we're looking to overlay with -- as we start to tie into distribution automation and other capabilities on a distributed basis.

And then, of course, what has really come to the fore over the last couple of years is the plug-in electric vehicles and they're really right on the horizon, they're really 15 months away. So there's -- you know, we're really on a critical path at this point around integration of these vehicles and trying to better understand what is the impact on the distribution system, how do we integrate these gracefully so we have a very effective customer experience. Because it's very important that people have a good experience with trying to buy a car, and then bring it home and then plug it in, and then have that become an effective tool to, you know, our overall clean air objectives and energy independence objectives, but at the same time fit into the grid in a way that causes no harm.

Within this broader context we really look at five basic elements, renewable, and distributed, and storage integration, grid control and asset optimization. Workforce effectiveness is very important, both in terms of how do we enhance productivity of the workforce through new technologies recognizing that, as I mentioned yesterday, there's a lot of new technology that the crafts people in the field will have to manage and maintain. And as a result, we need to provide tools to help them with that.

At the same time taking advantage of technology to improve safety of our folks in the field, which is always an important consideration for us.

The Smart Metering obviously plays as a critical role.

And then as we look at Smart customer solutions, from demand response, energy conservation that will support that, those objectives and, obviously, the plug-in electric vehicle, and things like home storage, which I'll touch on a little later.

Similar to the slide that the -- a variation on sort of the slide that Mike Gravely showed yesterday, we also see that all of these various policies that has either been enacted in law in the State, or through regulation, are moving us on a path over the next ten years which is really unparalleled in the country.

There’s no other state that is looking at the breadth and depth of -- and these aren’t all of them, but these are the highlights, that we’re looking at to be able to manage towards and be able to have a grid that supports these over this time horizon.

So within that context, you know, I sort of put forward a straw proposal about how we are thinking about it. And we haven’t finished our thinking, this is continuing to evolve this year, but that we start with sort of multi-stage. And I referenced this yesterday in terms of multiple phases of how we think about how we move forward over the next decade.

But in the first stage, which is really we’ve come -- we’ve completed in the past year, over a period from starting in the late nineties, where we started to do a lot of distribution automation, SCADA systems, distributed capacitor control, switch control, similar to what Tom mentioned, this evolution we got a lot of value out of that during that first stage.

As you move into the second stage, which is really where we’re in now, where we start to talk about Smart Meter systems, we start to look at the next generation in control systems, which I’ll get into, that next wave of investment, which is about one and a half billion dollars, and I’ll get that in the next slide, that starts to really build on that foundation and gets us to another level of performance on the system in terms of the controls and optimization that Richard was talking about, so this sort of aligns with Richard's model, as well.

Stage three, we start to get into distributed intelligence and automation, pushing it farther and then out into the field.

And then we start to look at micro-control, and what I call micro-control is where we start to think about things like vehicle to grid, or potential peer-to-peer transactions that have been mentioned. That, we believe, is going to be beyond the ten-year horizon.

If we get through these first pieces, I think we're going to really get substantial benefits and we'll talk a bit about that.

By the way, in measurement control systems in stage two we'll lay the foundation for doing things in stage three, somewhere between stage two and stage three, for things like green circuits. Voltage control and distribution circuits can potentially save five percent on energy efficiency, or create that much of a benefit.

That pretty much dwarfs many of the other things that we might be able to do in that time period, in terms of an overall benefit from a greenhouse gas reduction and some of the other things we might do on the grid. And I'll come back to that in a second or two.

So in terms of what we're doing and what I'm calling stage two, these are actual capital projects that we're implementing. So these have all now been approved by the Public Utilities Commission and are underway.

So obviously, the Smart Metering at the bottom is the big ticket item, but the other systems are also equally important.

So the energy management system is being upgraded, substation video surveillance for the security, as part of the SIP compliance.

Phasor measurement, we talk about that a lot as terms of pilots. Actually, this is -- this is actually deployment of the rest of the system. This will have a phasor deployment, the largest in the country, that will be all of that 502 and 230 KB system.

So this will -- this will complete that development, which will be what -- which we're looking forward to and also working with others. PG&E has mentioned this, and BPA, and CAL ISO.

In terms of remedial action schemes, we're looking to deploy a system to help us optimize how we do that, and especially with all the new interconnection generation and distributed resources, this is a considerable factor, so that we can optimize the operation, as opposed to the way it's done today.

We'll be expanding our distribution automation system. That's something that we're continuing to do, as well as replacing our distribution management control system will be replaced during this period.

The outage management system will also be enhanced, similar to what Tom talked about, and we'll be deploying the advanced load control system as part of our Smart Metering program.

This is something that we've been spending a fair amount of time, actually it's been five years in development, and we've been struggling a bit in the industry because the applications we had contemplated, which is also sometimes known as DRACS, that was a term we had come up with some time ago, actually Jeff Gooding on our team. And I know there's a project with the CEC to look at this.

We're actually in the process now of starting to implement this system and we expect this to be in operation by the end of -- or sometime in mid or actually spring of 2011 for summer, summer controls.

And then the renewable integration technology development, there's much more to be done here and we're starting to implement some of those systems to support that but, like I said, there's more to be done.

And then the PEV integration, that is on a fast track, that is on a critical path. There's much more to be done as we start to scale up, but those initial cars are coming soon, as early as fourth quarter of 2010, perhaps first quarter of 2011. And so not only do we have to have the systems in place, it's largely an infrastructure play.

So part of what we have to look at is the impact of somebody buying a car, and particularly if it had a fast cycle charge, we could be looking at 240 volt and as much as 70 amp. If it's a Tesla vehicle, it would require 70 amp service with 240 volt, and most homes don't have that capacity.

So you're talking about a service panel change, potentially in the meter, potentially a service drop. Potentially, as was talked about, that could be a couple of home equipment could exceed the transformer limit on the local transformer, that would then have to be replaced.

Those sorts of things are what we're trying to figure out because nobody wants to hear that they're going to have to wait six months to get all that replaced before they can start using their car. So these sort of impacts are pretty important.

The other is that these first cars are not going to be communicating, so working with the autos to make sure that they have the controls on the cars set as a default for off-peak charging, must like daytime running lights being set, you know, as a default to be on, we would like to have the autos do that and some of them are starting to work that into their models.

They have a long product development cycle. So when you start to talk to them about having communications or different functionalities to respond to pricing signals, you need to keep in mind that it takes about two years from the time that they finalize the design to the time it actually comes out in the marketplace. So that's something we're continuing to work very closely with them.

And in fact right now we're working with Ford and testing the Zigbee interface to one of the ECU units for their electric vehicle.

Phasor measurement, talked about that a bit already. This is just a picture of our situational awareness room. And continuing to evaluate not only how we can leverage this for monitoring and control, but ultimately getting into a machine-to-machine interface that we can have automated responses.

As was mentioned yesterday, this is cycling at about one-thirtieth of a second; we're considering and evaluating moving that to one-sixtieth of a second.

There's two major challenges. One is the amount of data that's coming out. At one-thirtieth of a second for the deployment we're going to be putting it on a 500 and 230 system. That will be generating four megabytes of data every minute.

So how do we filter that information, how do we store that information, which is huge amounts of data, and then ultimately building out the communication network that can support that and the other Smart Grid use is also something we're looking at.

The other aspect is, as I said, the machine-to-machine. We're trying to look at taking the human interface out of it so that responses on this grid, as it's happening so quick, if you had to have, insert an operator to assess something before it took action, you could have the event already happen.

So how can we start to look at having automated responses as a result of the data that's coming out of this system?

In terms of energy storage, you know, Rick talked about this morning, we are looking at many of these elements as well, so looking at different battery technologies, looking at compressed air energy storage, both with Mike, and the CEC, and EPRI, potentially trying to go after some Stimulus Funds for an above-ground storage project, but also looking at home storage.

So we have an application in front of the Public Utilities Commission for a pilot of 50 home storage units, that's hopefully going to get approved, and we'd be looking to deploy that later this year, into next year.

Distribution automation, in particular, we're looking to expand on the experiences that we've had with the circuit of the future project, what's out in San Bernardino.

This is a distribution circuit with some funding from DOE, that we've implemented, it has about 1,200 customers on it, this is a live circuit.

And we've been introducing a number of technologies, really transmission system level technologies, into the distribution system, but we need to take it further because those technologies can't just -- you know, on a commercial basis you wouldn't use it this way.

So we need to do, we need to involve those protection schemes to really address the kinds of things that we were talking about, with distributed resources, two-way power flow, and the like.

And similar to what Tom talked about, we have a project proposal that will be part of the Stimulus to go to something when we have two circuits, so that we can start to see them interfacing with each other, so that we can get into more of the self-healing.

This sort of self-isolates and there's a little potential to do self-healing.

The way we want to go next is to do that even more dynamically and then factor in, you know, the car and some of the storage, as well as the demand response, into this concept.

Many of you have seen these slides from us. These are now getting into more a pilot stage, over this year and the next is sort of combining these elements, so not just looking at this individually, but starting to combine them to see what the dynamics are in terms of how we interface with the customer on the information and the demand response pieces. And then I'll show you on the next slide in terms of how the various potential supplies or storage uses, in terms of the car and the battery can play in to get an ecosystem within the home that starts to hit the zero, you know, net energy objectives.

So how do we optimize the home in a way that it's its own little micro-grid and can be an effective system, sort of closed-loop system?

One of the things that Tom mentioned is about customer access to data. Southern California Edison believes the customers should have access to the data. The real question is, is that the rules that have been written around customer access to data were done for direct access and really pre-internet.

So if you look at the rules that were written, they're such that you have to have written signatures and the big innovation was having a faxed signature. This is, you know, 12 years ago. It's hard to believe that that's where we were 12 years ago, but that is.

So those rules have to be modified to account for the fact that we're in an internet age and that information may be more accessible. The current rules say that you can have access to historical data twice a year. We need to modify that.

So we see that there are two things that are really required, and we'll be taking more about this at May 27th, at the CPE's workshop.

But there's two things. One is we have to revise the process to account for the fact that we're living in an internet age and that customers are going to want to be able to access information and get approvals and give approvals through the internet, for third-party access to the information.

And the second is that we do need to have a standard interface. As Erich said, this automated data exchange is really important because we don't want to be building multiple interfaces for every third party that comes along. It's not cost effective for them; it's not cost effective for us, so it would be very effective for us to have a standard interface that everybody can use.

And I know that some of the big players are not happy because they're used to doing it their way but, unfortunately, this is not best done like Burger King, it's best to have it a single way so that everybody can have the same playing field.

And we're doing a lot of good work with Erich and other utilities around the country to get this standard.

In terms of -- and by the way, that would be something that would be as helpful as working on this gateway standard interface between black boxes that folks are thinking about and the back-end internet interface, too, because that's the other way where there's not standardization.

On distributed energy resources, I touched on this. We do see that this piece tied in between potential supply or storage, and/or storage, with the demand response capabilities or energy conservation elements that I showed on the prior slide. You really can get an effective, you know, load management for the home that can be totally automated and allows the customer to really manage their energy bill.

Which, at the end of the day, and all the focus groups that are going on with customers, that's what's really the most important to them. So we think that there's a really good opportunity to link all of these and allow this ecosystem to happen.

The utility doesn't really need to provide anything other than providing the information off the meter through a standard, you know, in our case the Zigbee or, potentially down the road, home plug standard interface. But the rest of it can happen through third parties and through the customer, and they can have a very effective solution.

In terms of networks, there's a lot of confusion about communication networks for the Smart Grid. It always depends on which perspective you're coming from in terms of where you sort of look at the Smart Grid. And what we find is, you know, to sort of use the analogy, if you're a hammer everything looks like a nail. If you come at it from a Smart Meter perspective, you sort of think about it one way. If you come at it from the phasor perspective you think about it another way. If you come at it from a SCADA, you sort of look at it yet a third way.

We need to be able to account for all of these because, ultimately, the information needs to flow across many of these elements and we need to think about how architectures can bridge these diverse communication protocols that are going to be involved, which is much of the work that you heard that Erich and Richard are involved in.

But we also need to account for the fact that these network components, depending on which aspect of the network we're talking about, have different technology lifecycles.

And we're always very cognizant of having fast cycle technologies, like cell phone or cellular technologies, next to long cycle technologies which may be more involved with things like fiber optic systems, that you're not going to be changing that out very often.

And we need to understand when we're designing networks that we won't know all the uses. We didn't know all the uses when we started the Smart Metering, and that was always a concern and a caution that we had, and we had many discussions over the last five years about that.

And it's certainly the case, as we are sitting here today in 2009, we have no idea what the world's really going to look like in 2015, and there are many things that we are going to know and come to learn, and wish we had known.

But what we can do is try and continue to maintain those basic architectural principles that allow flexibility in the system and in the design as we move forward.

And I think as a State we've been -- you know, we've had very good dialogues, and discussions and debates that have allowed us to have a very robust approach, I think in general, to these issues and we'll continue to need to do that as we move forward.

One of the things that I continue to talk about and I think Tom touched on, funding for some of these communication networks is going to be -- can be in some cases going to be challenging through the normal regulatory construct because often the benefits don't accrue only to the single utility as they're asking for the money to build that infrastructure.

This is particularly true with things that are going to be involved with transmission, where you may actually be in separate jurisdictions, across state lines. It could be where it's between Federal and state. It could even be at the distribution, where it may be related to others, or there's societal benefits that don't really count in our business cases.

I think you saw in many of the Smart Meter cases they were sort of break even as it related to the cost benefit, and a lot of that was because we really couldn't account for societal benefits that clearly were there and otherwise should have been accounted for.

And then, of course, we have to have a graceful transition plan between the as-is state, where it is today, and where we want to go in terms of the to-be architecture, because we're not going to be able to afford to rip and replace, we do have to have this graceful transition. And we're pretty confident that we can come up with one, but we do need to do that.

I've covered many of these points in terms of

Federal, state, and regional integration. I think probably the most important thing is things are moving very fast in Washington these days, and where we had been in California at the forefront and had the luxury of being anywhere from a year to two years ahead of where Washington and the rest of the country was, we no longer have that luxury.

And so to the extent that California participants, certainly the utilities are very active, the investor owns, but to the extent that the Commission and staff can spend some time in Washington, or more time in some of these workshops I think it would be extremely helpful, because things are moving very quickly and we may not be able to control our destiny like we used to over the past decade or so.

And I'll close with that, thanks.

MR. GRAVELY: Thank you, Paul.

So we'll hear from PG&E. Do you have your presentation on here; I'm trying to find where it is. This one here?

MR. ALVAREZ: Yeah.

MR. GRAVELY: So Antonio will tell us today where he's at.

MR. ALVAREZ: Thank you, Mike. I'm substituting for Kevin and I'm going to deviate a little bit from the focus of Paul and Tom.

My focus is going to be on the area that I work on, which is the resource planning area, so I'll be focusing on the impact that intermittent resources have on the need for resources.

I will also cover the approach that PG&E's taking with respect to learning and better understand those impacts.

And also on the role that demand response and other Smart Grid opportunities play in terms of helping us integrate additional intermittent resources.

I think it is fairly clear by now that with intermittent resources we have a variable source of generation that is difficult to forecast. As a result, the system needs to be a lot more flexible than it is today and that requires that we have additional amounts of regulations we're following, and ramping resources that are able to capture the balance or the deviations that exist between the forecast and the actual power that we receive from those resources.

Today the resource need is determined by a single function, which is based on the expected peak of the month, or the year of the load-serving entity, plus planning reserve margin.

That planning reserve margin, unfortunately, does not account for the flexibility that the system needs. That planning reserve margin is generally determined by something that in our industry we call loss of load probability, which is you need to have enough resources in order to cover the deviations in load necessarily were higher than normal summer temperatures, and also the outages associated with the resources that we have.

So a question we are trying to ask ourselves right now is whether, as we increase the amount of intermittent resources in our mix whether we have the right equation in terms of determining a need for resources.

One other point that I would make it today’s preferred resources, and I’m referring to energy efficiencies, and demand response, and distributed generation do not help integrate those intermittent resources. I’m saying in the future they might help but today, the way the programs are designed, they don’t contribute much to the integration.

The preliminary studies that the California ISO has done with respect to the need for integration resources has shown that there’s a significant amount of ancillary services that are needed in order to accommodate a 20 percent RPS, and I believe this analysis that was done in 2007 assume about four or five thousand megawatts of new wind.

If you think, for example, today the ISO carries about 350 megawatts of regulation; this would significantly increase that amount of regulation that would be needed, the same for any -- the load power and capability that is needed.

Right now the ISO is updating integration analysis for the 20 percent RPS target, and the ISO is also planning to start integration of 32 percent RPS later in the year. We expect that the findings of that study will be key in determining the need for resources, that eventually will get decided by the California Public Utilities Commission in the next long-term plan which, hopefully, will happen in 2010.

Our approach to the integration of intermittent resources is a little bit different in the sense that we have decided not to embark on another integration analysis and we have decided to develop a tool that would help us understand the drivers for that integration requirement, and the drivers for the integration cost.

So we have built what we call an integration calculator and it is a tool that is flexible enough to be able to define the additional amounts of load and intermittent resources that are added to the system.

We're able to define, also, the parameters that define the variability and the uncertainty of that additional load in intermittent resources, and we're able to estimate integration cost, as well as the integration requirements of additional intermittent resources.

The tool can be tailored to examine the needs of a large system, like the California ISO control area, or individual load-serving entities.

And again, this is a tool more for communication, for learning what drives those integration requirements.

At this point we have given the tool to the ISO and the ISO is reviewing it. We hope that it can contribute in the finding the answer for the integration requirements for the 32 percent RPS.

And these are some samples of the output that we can create with the tool. For example, the top diagram we have estimated the load following capability that is needed in 2020 to add different levels of Tehachapi wind to the control area, to the ISO control area.

We also are able to estimate the variable and the fixed cost of integration as we add additional amounts of wind.

And so we are making this tool available and because as we see it, it is important that the industry understands what drives the requirements, and we’re able to communicate and, you know, understand in the dialogue what drives the need.

Just touch briefly about the role of demand response. I think others have covered the same topic.

About three things that I think, in my mind, we need to have for demand response to contribute in the integration process. One is we need to change the way the programs are designed today. Demand response is designed to be used for just a few hours in the year, stress hours when the system is close to running out of resources.

So we need to expand the use of demand response in order to provide more continuous support in a fast response, as well, so that we can cover those or at least contribute to covering the deviations associated with the forecast of intermittent generation.

And there's also a need for additional visibility so that the ISO understands what resources it's getting, or what contribution is getting from demand response and can, accordingly, you know, adjust the dispatch for its remaining resources.

We also have a number of Smart Grid projects and opportunities that we're exploring and we have several pilots that have been proposed to the California Public Utilities Commission, taking advantage of thermal storage.

Some of the examples, you know, everyone probably in this room knows them far better than me. And we're also looking at plug-in hybrid electric vehicles.

And we are also looking at different kinds of storage, from the wholesale, you know, pump storage and compressed air energy storage to the distribution level storage.

And that’s all that I have, thanks.

MR. GRAVELY: Thank you. We have one question. If there are any more questions from the WebEx, be sure and type them in and we’ll bring them down.

The question we have, actually, I think is for Richard and it has to do -- it’s from Mary Kimberlin and she’s asking, “does the Japanese use dedicated power lines that could heal through fail-safe procedures?”

MR. SCHOMBERG: It’s Richard Schomberg. Well, I don’t know, I’m not sure. I don’t want to say, make a blunder. I don’t think they do, but you should check, double check.

MR. GRAVELY: Okay. Anybody, questions from the audience? Now is the time.

MR. BROWN: Merwin Brown, CIEE. I think this is a question for the whole panel.

The subject of data sharing has come up from a number of the speakers, but I’d like to ask the question in a broader sense, I can -- we’ve already started getting into the question of data sharing with synchrophasors, and this is data sharing potentially throughout, say, the whole western interconnection.

And I can see the day where we may need or at least want to share even data at the customer level, because I can see the day to where the way we approach load modeling today isn't going to be sufficient to maintain the balance over the system without a more real-time approach to load behavior, when we start bringing all these different kinds of loads and generation at the customer's.

So I guess my question is are we in good shape on data sharing, is this something that's going to be easy to do or are there barriers to sharing this data as we go forward?

MR. GRAVELY: Thank you. Anybody?

MR. DE MARTINI: Well, this is Paul DeMartini from Southern California Edison.

What I would say, today has been slowing down at least on the transmission level data sharing, is the fact that there's been some concern based on some experiences in the last, you know, decade where information was shared and then some oversight groups then sought to penalize people based on data that was then found to have uncovered some phenomenon.

For example, in the phenomenon that was identified related to air conditioning installing, which was identified as a result of looking at large amounts of data, and this phenomenon was identified through sort of this forensic analysis.

When that was shared and then sort of in the context of a productive discussion, later there was the potential for being penalized for having had found this problem.

So I think when we start talking about synchrophasor information, this, I know, has been slowing things up, is to have sort of these safe harbor provisions where, you know, providing the information from an historical perspective, but not necessarily being used against you in the sense of trying to get information out there.

You know, we all sort of shake our heads as, you know, folks that don’t understand how do we move the ball forward on technology, but the fact of the matter is these are real issues that are slowing things down. So, you know, we need to take that into account, I think that would certainly help.

And then I think on the customer side, Merwin, to your point, I think when we move down there it’s just a question of how do we protect the privacy issues of the customer and I’m sure we can work through that. But, you know, those are things that we’ll -- you know, from an aggregation and grid management perspective. I assume these other aspects are going to get worked through a lot quicker in terms of customers providing access to third parties.

MR. GRAVELY: Anybody else? Thank you. Any other questions?

MR. TRALLI: This is Dave Tralli, JPL, again.

A question on hydrogen fuel cells, I haven't heard anything in the last two days.

I think as recent as last week the DOE has announced that all its investments in the past, in hydrogen for vehicle use, is going to transition into a stationary application. So I was wondering you guys could comment? I'm sure it's a time horizon kind of issue, but where do you see hydrogen, hydrogen generation for renewable sources and that in the mix for storage on the grid?

MR. DE MARTINI: Well, in -- again, this is Paul DeMartini.

In terms of the transportation sector, I mean we are continuing to evaluate hydrogen vehicles, you know, and we continue to look at that. I think where it's coming down at the moment is access to the fuel.

So when we look at the alternative fuels, it's pretty clear that electricity's got pretty good distribution capability in terms of access, whereas hydrogen, there isn't an existing infrastructure to be able to support that on a mass scale.

That doesn't mean that it couldn't happen. We continue to evaluate it and, actually, there are a couple of manufacturers that are still pursuing those developments and we continue to work with them, and we test some of their vehicles.

But, you know, I think in the near term we see a real strong push towards electrification of the transportation sector and that's something that we've been spending a lot of time on as well, and more so as these vehicles are starting to come to market.

MR. GRAVELY: Okay, thank you. There's a couple real quick questions on the line here, and one of them is "are any fiber optic systems being used in Smart Grid systems?"

So I'm assuming, for example, I'm aware of fiber optic backbone systems being used for telecommunications in conjunction with Smart Grid, for broadband over a power line, and for broadband systems.

Are there other known systems that are relying on fiber optic backbone?

Go ahead.

MR. DE MARTINI: Yes. I mean we -- the distribution circuit of the future I mentioned is Avanti circuit. It is using fiber optic connection between the protection schemes to be able to meet the latency requirement.

Those field devices have to understand where the fault was, clear those device -- open up and sectionalize the circuit in less than 50 milliseconds, which is the time otherwise the circuit breaker at the substation trips.

So getting that fast response initially we put fiber optic out. That's not -- I mean, from a test stand point that helps us understand what that dynamic, but from a cost stand point, it's not cost effective.

So we are looking at, you know, looking at other alternatives in terms of wireless technologies might be able to be -- to be able to meet the latency requirements.

But, you know, as fiber optics continues to be pushed out in terms of the telcos continue to put more pervasive fiber optic out in the networks -- I'm sorry, out in the neighborhoods, there may be opportunities to leverage that, but we continue to watch that.

MR. GRAVELY: Go ahead, Richard.

MR. SCHOMBERG: Yeah, we could mention, also, what Oncor, in Texas, has been doing there. They have been pulling 5,000 miles, I think, of fiber optics through all their substations. So it's really along with what you said.

If you allow me, I would like to say something on hydrogen, on the previous question.

MR. GRAVELY: Sure.

MR. SCHOMBERG: Which is there still a major issue regarding what is hydrogen, which is just an energy vector, not a primary energy. And if you look into the energy efficiency equation or the CO2 equation, it is still a big issue, because to produce hydrogen today, if you produce it with the existing technologies, it's not efficient. There are many studies that shows terrible things, that you're going to use more energy than you can actually, really move through hydrogen.

But the point I want to make is that when we're going to have the high temperature nuclear reactors, then with the temperature you can crack water for nothing, it's marginal cost, then you can produce hydrogen in good conditions.

And there is another very interesting technology which would be cracking the water through thermal solar. And those are two breakthrough technologies that would be needed to actually make a huge difference and maybe put hydrogen again at the front line.

MR. BIALEK: And one thing I wanted to add about the sort of the fiber optic piece as well, depending upon how you wanted to define the application in Smart Grid systems, there's people out there selling optical PTs, and CTs and various other kinds of measurement devices for temperature, as well, that are being used in Smart Grid applications.

MR. GRAVELY: Thank you. One last question and I'm not sure I understand the question, so it's up on the board there and I'll read it. It says, "PLC are used in automation of manufacturing to meet PLC to interlock the computer," so I'm not sure what PLC stands for -- "so are we going to manufacture energy or is it just a control facility?"

So I don't know if anybody feels like they can answer that question? Maybe we can have MaryAnn clarify it during the break and we'll discuss it at the next panel, but I -- anybody have any suggestions for an answer to that question?

MR. HOFFMAN: Programmable Logic Controller.

MR. BIALEK: Programmable Logic Controller.

MR. GRAVELY: Controller. Right. So, I mean, yeah, for PLC. Programmable Logic Controller is a standard one, but I'm struggling with how the second half of the question relates to the first half of the question. Any suggestions?

Okay, we'll ponder that over the break. If Mary wants to re-ask the question, we'll try and answer it the second time.

So thank you very much, all of you, we appreciate it. We have three additional speakers that will come after the break. Let's take a ten-minute break and we'll come back. And we're actually a little closer to schedule so things are looking better.

Thank you all very much.

(Off the record at 3:00 p.m.)

MR. GRAVELY: We'll start now. So we do have still quite a few online, down 26, so probably 65, 70 people still participating at the WebEx and we appreciate everything.

I think in the interest of the break here, our next speaker is out in the hallway, so he'll be here in just a second. So we'll give him a --

So this afternoon's session we will hear from SMUD, as well as -- let me get our proper names here. Right, okay, so from GE and S&C Electric.

So, Michael, I'll let you start off the session here and here we go. It's all yours. Thank you.

MR. DE ANGELIS: Okay, we're pulling up the tail end of this workshop here today, huh.

MR. GRAVELY: The most important part.

MR. DE ANGELIS: That's right. Okay, what I thought that I would try to cover is a bit more on the -- based upon the questions that were cited in the workshop notice, and based upon the workshop notice, itself, today and our vision to 2020. I thought I would try to cover, particularly from SMUD's perspective and the energy supply perspective our policy vision for the future. And I will make comment about the Smart Grid all along the way, but the focus will really be on a lot of SMUD's policies for the near future based upon our Board of Directors' decision.

I think as most of you know, SMUD is a locally elected board, we serve the Sacramento County, and we also operate a balancing authority from the border of Oregon all the way down south of Sacramento, to the Modesto Irrigation District and TID area.

I thought that what I would cover is really some of our Board's policies related to sustainable power, how we've planned our very aggressive sustainable power goals as decided upon by our Board; and then our renewable energy supply goals and status, some of the issues that we run into there; and then move into the distributed generation and distributed storage, of which we do have programs on, too; and then end up with kind of the Smart Grid functionality slide, as I would call it.

So first of all I think in December our Board of Directors did approve a very aggressive sustainable power supply goal for SMUD. And really what this reads, this is the actual words that they did approve, what they did approve was really a definition that said that SMUD would reduce its greenhouse gas emissions, its CO2 emissions by 90 percent out to 2050. And a very, very aggressive goal, clearly.

And in fact, as most of you know, SMUD is one of the lowest greenhouse gas emitting utilities in North America, so that makes it even more of an aggressive goal.

The reason for that goal, of course, is the recognition that we do need to stabilize, worldwide, our CO2 emissions, or at least stabilize the warming, and the science says we need an 80 percent reduction by the middle of the century.

So SMUD is moving forward to say that it is going to have a sustainable power supply that’s 10 percent of its 1990 carbon emission levels by 2050.

And the way this works is that we have to report annually to make sure we’re on the track to get there and we will start that.

This particular slide does show where SMUD fits amongst other California utilities. This is based on data collected by the Public Utilities Commission, based on data submittals, and it shows that SMUD is already very low emitting.

PG&E is the major utility that is lower than us. They have a nuclear power plant that does reduce their emissions even more. We shut down our nuclear power plant in 1989.

This slide is fairly detailed, but what it shows is really how past policies have already had a huge impact on greenhouse gas emissions at SMUC.

First the top line, let me explain, the top line is really SMUD’s electricity demand and how it has grown historically from 1990 up to today, and then what our projects are for the future, which is a certainly flatter demand.

The dark blue, solid area on the bottom is our greenhouse gas emissions. Again, historically, and then for the future our projections for greenhouse gas emissions.

And what you can see is the other bars historically, and projected out in the future are some of SMUD’s historic policies. It shows that are historic policies for energy efficiency has had a major historical impact on reducing green house gas emissions, in addition to when we did shut down our nuclear facility in 1989 we decided to build a -- three cogeneration facilities in our service territory, and their more efficient use of gas has also saved greenhouse gas emissions, compared to if we built a state of the art gas fired plant at the time.

And again, our RPS and our Greenergy program, our two sources of renewable energy supply, also have reduced greenhouse gas emissions over time, as has our low CO2 procurement, which is primarily hydro procurement. So it shows the past policies and their impact on the future.

However, we do have a predominant gas-fired emissions; we are about 60 percent gas fired generation at

SMUD. We have very aggressive energy efficiency programs that Jim Parks, who's in the crowd, can tell you more about if you want to know.

We have a 2020 33 percent RPS and our Greenergy programs adds another four percent on that for 2020.

So our plan to get on this trajectory to reduce greenhouse gas emissions is really to grow renewable energy supply, maximize the amount of energy efficiency, cost-effective energy efficiency that we can support and incentivize. And what we will do with the results of that is back out fossil-fired purchases out to 2020.

Then when we get out to 2020 we can see these bar charts, we have cogeneration plants that were built in the 1990s, their bonding will hopefully be -- or are planned to be paid off in about the 2020 to 2030 time frame, depending on the cogen plant.

And the plan to continue to stay on this trajectory of the 90 percent CO2 reduction would be to begin reducing their output come 2020.

Or what we could do is if the technology comes along and we can sequester CO2 emissions, we could do that, or even by offsets, if offsets are an available option at that time.

We also have a 500 megawatt gas-fired combined cycle power plant, called Consumnes, that's the bottom, darker bar chart there. And what you can see is the bonds will be paid off past 2030 there and to stay on the trajectory, we would have to begin to curtail that.

Now, what that means is we have to grow renewables past 2020 in an aggressive way, continue with our energy efficiency programs aggressively, beyond 2020, otherwise our projected emissions will begin to rise, or we have to develop offsets or carbon sequestration.

It kind of shows you graphically a little different way of looking out to the future, that beginning 2020 we have this gap we've got to fill, and that's the green side there. Even though we're aggressively reducing, via energy efficiency, our demand down to the dashed red line on top, and we have aggressive renewable energy supply goals. So that's that chart.

Specifically, our renewable energy supply goals are listed there. You can see our 2008 supply goals, we have been very good in terms of meeting those supply goals in the past and we do expect to meet our 2010 goals, which is 23 percent for both RPS and our green pricing program, called Greenergy.

The last project really comes online this summer, it's on schedule, we expect to meet our 23 percent goal by 2010 and, of course, our 2020 goal is 37 percent combined for RPS and Greenergy.

Looking at it from another perspective, and I do want to say this chart is somewhat revised, in the last few days we did get some revised numbers. The 2008 actual is 19.5. I don't know if any of you have printed that out. It was 19.8 I think before, so it was just a small change.

This one is also revised. What this shows you is our goal is the bar on top and our supplies that are signed up and operational is the dark blue.

As you can see, we've exceeded our goals in the past and we expect to meet them in the future, out until, oh, let's see, 2011, we're slightly under, but we can just carry over according to the provisions of the PUC.

And the dark green is our Solano Wind Power Phase 3 project, which is 130 megawatts.

But you can see out to the future, as our renewables contracts begin to end, why you can see that the dark blue gets smaller and smaller and our gap gets larger, but we continue with a whole set of activities to grow renewable energy supplies.

SMUD owns and operates renewables power plants, we also conduct an annual solicitation, and we accept proposal any time during the year, too, we have the ability to do that.

Where we're headed in the future is to really aggressively pursue a lot of local projects. For renewable energy, we really have solar and biomass, those are our only two sources within our service territory. It is broader within our balancing authority, all the way up to Oregon, though.

Our plans are to build transmission north, that's where we are headed, and we want to access renewable energy supplies in northeast California, the northwest, and also Nevada and, eventually, connect well to other transmission lines bringing renewable energy in towards California.

We have focused a lot on emerging technologies, technologies that are just developing out of R&D and emerging in the marketplace. We're really in some very interesting solar, biomass, hybrids, with biomass gasification, and other types of technologies.

And we've already completed an intermittency study for SMUD, which shows very similar to results for renewables intermittency as other studies that have been done. And what they really show that for wind, specifically, that as you get out to 15 to 20 percent capacity of your peak load, you begin to run into some problems with controls, with controlling that and filling in off the side, the costs begin to go up significantly.

So we do believe that there's a lot of work related to the Smart Grid with advanced control and communication technologies that can help us with the intermittency problem.

We do have this SMUD’s owned Solano Wind Project, that’s 105 megawatts down there in Rio Vista, that we’ll expand by another 130 megawatts in the next couple of years. You saw that as the green increment on the bar chart that we listed for renewable energy supply.

We’ve had some issues getting the last phase of that project going because of radar issues down in the Fairfield area, with the Travis Air force Base.

Wind, however, does create the intermittency issues. The top chart really shows you annually it looks very good because it does supply more energy during the summer, our wind plant down in Solano.

Unfortunately, if you look at it daily, it is not so good, because it tends to ramp up in production, the bottom chart, the blue line, it tends to ramp up in production in the late afternoon and doesn’t reach its peak until after our overall peak occurs.

So managing intermittency is an issue and a lot of the advanced communications and control technologies will help us get there.

Also, what we’re planning in the future is potentially advanced storage. We have both a distributed storage program and also we have had, in our FERC re-licensing of our hydro plants, up in the Sierras, plans for a pumped hydro storage project.

This shows you kind of an artist's rendition of what it would look like. It's a 400 megawatt project. It is in the planning stages, as I mentioned.

We've been meeting a lot with the local community, up out of the Apple Hill area, discussing the project and thinking about mitigation options for such a project.

So we are planning on doing that. And, of course, it's right next to one of our smaller hydro reservoirs, which is the Slab Creek Reservoir, down at the bottom, and it pumps through the mountain up to the top of the mountain, where you can see that berm up there, which does contain a 6400-acre-foot reservoir, which then could be released to generate electricity when we need it the most, to address our intermittency issues associated with some of the renewable energy technologies.

So that's kind of the plan on that particular project. We'll see, it probably -- you know, we'll go through the environmental reviews, the earliest that project will probably be in place would be after 2015, we would expect, but that kind of fits with a lot of our plans to grow renewable energy, including intermittent renewables.

I should say that to date we've been focusing on base load renewables. About close to 60 percent of our base load -- of our renewable energy supply, out through 2008, has been through base load renewables, geothermal and biomass. But we do have 33 percent, that's wind, and we expect that to grow in the future, also.

We have a distributed generation program and a storage program, with related to renewables, and also with CHP. This shows you some photographs, a solar PV. We do have a couple of dairy digesters. This isn't a picture of one of them, it's one back east that is a little bit more photogenic than the ones that we've just installed. But we do have two and we've offered a number of incentives to get these programs going.

We're trying to focus a lot on growing renewables in our service territory so that we don't have to build transmission. But we believe, looking at the magnitude of the issues for reducing greenhouse gas emissions, we will need transmission to access renewable energy supplies.

We are focusing a lot on biomass wastes, where there's an environmental problem associated with a biomass source, like dairies, grease waste, food waste, landfills. We're trying to work out ways to divert that, solve the environmental problem, and generate green electricity at the same time.

We've established a number of financial incentives, particularly for our dairy digester programs. We've had a net metering program for a long time that we have extended the biomass, also locally.

We don't have within our service territory substantial wind resources, so we don't see that, it's primarily biomass and solar.

We provide a lot of technical and regulatory support for some of these biomass and solar systems, and we are -- have proposed in our rate case a feed-in tariff.

The feed-in tariff, if approved by our Board sometime this summer, would be in place beginning in 2009. It would be up to five megawatts. It kind of fills a gap in a lot of our programs right now because the feed-in tariff is basically a standard offer contract, which is take it or leave it, it's not a negotiated contract.

But it will have time-differentiated rates and they will be significant time-differentiated rates during our super-peak period. They will be really significant, based upon the work I've seen right now.

And so we expect that program to move forward and be in place by January.

We also have a CHP program, a cooling, heating and power program, and kind of the beginnings of a distributed storage program. I should say that most of the numbers that we've collected on the distributed storage right now is showing that it cannot compete very well economically with the large centralized pump storage system, but we're hopeful that there will be some breakthroughs and new technologies there as we move forward.

We also know that for distributed storage, it’s very hard for us to determine all of the benefits of distributed storage. We’re really struggling to identify all of the benefits. There’s a long list of them and there’s only some of them that we can quantify, and that gives us challenges as an organization.

We are working on CHP systems and district energy systems for the rail yards. Some of you may know that major development downtown, Blue Diamond, Folsom Prison, and a whole number of other sites where we’ve done feasibility studies, so we are trying to move aggressively forward in that area, too.

We have a CEC contract on a -- with the PIER program, on micro-grids. And again what this is, in terms of Smart Grid-related application, this is where you would hook up a couple of systems, distributed generation systems, right at our SMUD campus. We have a central plant that provides chilled water and hot water to several buildings on our campus, and we would install a small, reciprocating engine with a controller, that would also control a small PV system, so we can get some real world experience on this.

And the idea behind this is that typically distributed generation systems, if there’s a disruption the grid, the distributed generation systems go down and they are required to stop operation because somebody's got to work on the grid for safety reasons.

What this would do is this has an automatic control system, developed through the PIER program I should say, that would automatically isolate those distributed generation systems from the grid without disruption, so a greater degree of reliability would exist for the customer, so they would operate there.

And then when the grid is repaired and back online, it would seamlessly, again, integrate back with the grid.

So it will provide us some real world demonstration experience with this technology.

And the reciprocating engine that we would install would augment our chilled water and hot water supplies for our buildings.

Finally, and I think I'll conclude with this very detailed slide, but it does address, in terms of distributed generation, key areas where the Smart Grid can -- fits in beautifully to our energy future with distributed generation.

Do you see the kind of brown boxes that you should look at, and as storage develops for photovoltaic systems, which we have a lot of great hopes with plug-in hybrid electric vehicles, with lithium ion batteries, for example, where you could install some storage.

The way our super peak period for SMUD is, it’s really two to eight o’clock. And by the time we get close to six o’clock, five, six o’clock in the summer months, the PV system starts declining.

So the way this could work, if we did have lower-cost storage for the PV system, in the mornings, during off-peak periods, it would -- could charge the batteries and then re-release the energy during the evening time, so we did cover our full super peak.

So there’s an area related to the Smart Grid that would be -- that fits.

We also have, of course, demand response periods through the AMI programs that SMUD is moving aggressively forward with, with Smart Meters.

And this whole communications and control network that would be facilitated by the Smart Grid can really help our utility distribution system, our utility transmission system, et cetera. It can help with communications, it can help with automation, and that’s really what a lot of this slide does show.

So that, in summary, is what I wanted to present, so thank you.

MR. GRAVELY: Well, thank you.

In the interest of fairness, we’ll go ahead and have the two full presentations and then we'll take all the questions at the end.

So I want to shift, now, and hear a little bit from the industry side of the world. And Dave's going to give us some update on the GE side of the world.

MR. MC CALPIN: Great, thank you.

Well, it's a pleasure to talk to you a little bit about what we're doing on the -- in the GE world. For those of you who were here yesterday, I spoke a little bit about some of this, but I'll tell you in a little more detail what we're doing on the consumer side of GE to provide solutions in anticipation of the Smart Grid coming to life.

Just as a brief introduction, GE Consumer Industrial is the -- is the consumer side of GE, as well as our electrical distribution products. We make the light bulbs, as well as all the major appliances and electrical distribution products.

And what I'm going to talk to you about today is what we're doing and what we're bringing to market in order to help address the challenges presented by residential demand. As residential demand continues to grow and representing 30 to 40 percent of the total overall energy consumption we anticipate the need for solutions to help consumers shed and shift that load.

And as you look at the overall load and, clearly, usage patterns and relative shares of overall consumption vary by region within the country. But in general, about 50 percent of the energy consumption is around heating and cooling. This is an area that's received, historically, a lot of focus and we anticipate that it will continue to receive a lot of focus.

We serve some of this market directly with room air conditioning products, and we also anticipate helping in the load shedding portion of this, this portion, with thermostat products as well.

But as we look at some of our -- the main of our core portfolio of products, there's another 30 to 40 percent of the energy consumption that we can address with smarter solutions within that portfolio, and in particular I'm going to talk to you today about the 20 to 30 percent that we can address with appliances, including the water heating products.

You know, we pulled some very -- this is a big data bed, data from Lawrence Berkeley, using California as an example on the peak challenge. This would represent residential consumption, residential peak during a summer season in California. And you can see, obviously, that a big component of that peak is the air conditioning as you move into the latter part of the day and people return home. And, you know, clearly that's going to be a part of the solution. But simply asking people to turn off their air conditioners is not, obviously, going to be an acceptable solution to consumers.

And so what we're trying to do is identify other alternatives that will allow us to pull down that peak during that period of time, with a minimum of inconvenience to consumers. You know, while shaving some of the air conditioning peak off would be desirable, so also would be simply, you know, leveling the line within refrigeration, or pushing the dishwasher load out of the peak time frame. And so those are the kinds of things that we're prepared to do and that we're going to talk to you about.

And, you know, conceptually, obviously the objective is as we look at the peak and how it reduces that margin toward the available supply, the desired effect is to shift some of that load out of that peak period into other times of the day, and we believe that demand response-enabled appliances are a key component of being able to do that.

And one of the things that we think is important as we think about this is that we historically, as we think about efficiency, and we've done a lot to drive efficiency within our products, and when you look at a refrigerator consuming an average of 68 watts anymore, we have taken a lot of the energy consumption out of the refrigerator.

But when we think about peaks what's important is what is the -- what is the maximum consumption at any point in time that that product is drawing?

And so on a refrigerator, while 68 watts is the average that it uses over the course of a year, it uses ten times that in its peak operation period, for instance when it's defrosting, and so thinking about those peaks and how we prevent some of those peak consumptions, those peak drives during the peak usage period is a big component of what we are working on.

And it's an even more pronounced effect when you look at a double wall oven. You know, that product uses an average of five watts of energy over the course of a year, but in peak mode it uses ten kilowatts. So, you know, again, focusing on the peak draw of those products is where the opportunity is to help to bring down the overall consumption peaks.

And then, similarly, if you look across the products and look at the maximum draw and the rate of saturation of those products, penetration of those products in homes, there are big opportunities within products like dryers, water heaters, obviously HVAC has been discussed, washers, dishwashers and, you know, in the dishwashers you've got a kilowatt of energy. If you can just take that use out of the peak period and you start to multiply that across millions of homes, it's a huge opportunity that in our experience, and we'll talk a little bit about the test we've been running with Louisville Gas and Electric, consumers are perfectly comfortable doing.

In general consumers don't particularly worry a lot about when their dishes are done, as long as they're clean when they get up in the morning. So there are a lot of opportunities to, in a smart way, in an automated way, that requires a minimum of consumer intervention receive a signal, understand when the demand is pushing the capacity, and be able to adjust usage patterns.

And so we don't really need to talk a lot about that particular one. But when we look at the overall residential consumption and you take this portfolio of appliance products within the home, all those products operating at peak usage can draw as much as 30 kilowatts of energy.

And so what we've challenged our product technology teams to do is to identify areas that we can reduce overall consumption by 20 percent in a peak period. So, you know, assuming load factors and knowing that not everything's on at a given point in time, we believe that there's an opportunity to save as much as two kilowatts of energy during that peak period with the kinds of solutions that we are providing.

If you think about that, if just 20 percent of the homes in the United States were to reduce their consumption by two kilowatts, that’s the equivalent of 50 gigawatts of new capacity. You know, if you start to think about demand reduction as an alternative to demand generation it becomes a very, very significant factor in the overall solution to our challenges.

So we are -- as we have designed our system and the products that we’ll be bringing to market this summer, beginning this summer, we have anticipated that there will be more than one communication vehicle. We don’t think any one communication platform is the right answer for every utility in every situation, the simplest system that we envision, and that we’ll be prepared to respond to, is an FM or IDS communication coming from the utility.

In fact, in our laboratory in Louisville, we have a signal coming to us via the public radio station, a transmitter at the public radio station and appliances responding to that. And those appliances then have a radio receiver that is able to detect that signal and able to read that signal to determine what level of rate structure we’re in, and use that then to determine what kinds of activities it will default into to reduce the consumption of that product.

And the objective here, the way these are designed is that they're automated, they have overrides for consumers who need the product to do its normal state of operation, if that's what their lifestyle at that point in time requires, but they would default into some mode of reduced energy consumption.

Similarly, in a more complex kind of arrangement, with the signal coming to a Smart Meter on the home, that Smart Meter then relaying that signal into the home by way of a Zigbee kind of mesh network, or a home club type of signal, transmitting that signal then to the appliances.

Similarly, the appliances then, the radio on the appliance would then be able to receive that signal.

We are engaged with the U-SNAP Alliance and we do have these designed in a way that it will be simple to change the receiver in the product so that it can accommodate whatever technology might be available in that market for that consumer.

And then we also anticipate the presence of -- in some homes, those who wish to have a high level of sophistication in the way they manager their energy, a Home Energy Manager, which is another product that we are working on bringing to market.

And so as we look at some of the products and how they work, and when they'll be available, I mentioned in yesterday's discussion we have a product we're very excited about, coming later this year, it is a hybrid heat pump water heater. A typical electric water heater will consume roughly five kilowatts, kilowatt hours of energy. This one will reduce that energy consumption by half, at ten cents a kilowatt hour, it's $250 in savings a year to a consumer.

Equally as important is that we've embedded the demand response capability within this product. This product is our first one that's designed from the get-go; we'll never one that doesn't have this capability built into it, to receive a signal.

And the way those are designed to work is that that product will have a resistance heater, as well as the heat pump. The resistance heater is there for a quick recovery. When the system is used, the maintenance is done with heat pump as well as during the day, when slower recovery is acceptable, that will operate in normal mode and call it level one, when rates are at their lowest level. That product will operate in its normal state; it will pick whichever type of heat it needs to heat the water.

In a level two type scenario will, you know, the product receives a signal that the price has gone up and we're moving into a different period. That product can go into a heat pump only mode, so that rather than shifting back and forth between a resistance heater and a heat pump, it would be in a heat pump only mode.

The typical electric water heater consumes about four and a half kilowatts when the resistance heater is on. The heat pump is about 800 watts. So we can reduce the energy consumed in peak mode by about 80 percent, so three and a half kilowatts in this particular case, so a big opportunity.

In addition we can -- we would also have this product set up with a more reduced state of consumption where, you know, when we get into a critical mode we can further adjust the operation of the product to change the temperature that it’s set at for a period of time, until we move out of the peak period, and then return it to the normal set temperature.

And of course, similarly this product, the consumer would be able to go down and override that, if they wanted to. But we believe in most cases, and the results would indicate it from our test that we have in the field currently, consumers are relatively unaware of those changes that are happening yet, at the same time, they’re saving money by reducing their consumption during those peak periods.

Similarly on a dryer, a dryer will draw to five and a half kilowatts of energy in its peak mode, when it’s running. We believe that we can -- the default mode on this product would be to simply shift, you know, go into delay.

So the consumer turns the dryer on and it would simply indicate, you know, we’re in a higher priced time frame, you know, it will delay and turn on in X period of time. If the consumer chooses to override that, then it would go into -- it would recommend a reduced energy mode so we would, instead of one of the -- two of the heaters, we might run one of the heaters and extend the time that it takes to dry the clothes.

Again, if that’s not acceptable to the consumer, then they could override that and go into their normal mode.

But the objective here in everything we’re doing is essentially recommending to the consumer those kinds of energy saving things, and only when that’s not an acceptable solution to the consumer would it get overridden.

We will, in June and July of this year, we will have the first suite of appliances that will include laundry products, as well as all of the kitchen products, with demand response capability, commercially available.

You know, we’re actively working on a number of Smart Grid demonstration projects that we are trying to get these products into so that people -- we can get them out in the field and people can start to get comfortable with and understand how they operate.

As we move into the latter part of this year and early next year, we’re going to also be bringing a Home

Energy Manager, thermostat type products to market as well.

Just briefly, to wrap up, I’ll share with you a little bit of our experience in the one field test that we do have going right now in Louisville, with Louisville Gas an Electric, which is a unit of EON, we have 15 homes where we have been running a pilot since last summer, we have anywhere from three to four appliances in those homes that are on -- that are installed with demand response capability. It was a component of the pilot, also, that these homes would go to time-of-use pricing.

So LG&E is sending a signal to these homes, based on time-of-use pricing it ranges anywhere from four cents to 31 cents a kilowatt hours and the appliances are receiving those signals and automatically reacting to them.

We’ve conducted, already, a couple of rounds of focus groups with the consumers to understand how well they like it, how well they even understand what’s happening in the background, to what extent they can see savings in their bills.

And I can tell you that we’ve had one or two things where we’ve had to go back and rethink the way we were doing it. We were dimming a light on a microwave that was a task light, that consumers let us know that when they turn that on they expect to be able to perform the task, and so that one didn’t work so well.

But in general all of the things that we're doing, things as simple as the dishwasher, you know, it's got a delay start on it, 95 percent of the time when that's offered to the consumer to delay the start of their dishwasher they accept it and we push the consumption out of the peak. That's a kilowatt every time they do that, so it's a big deal.

And they're starting to see the benefits in their utility bills with the variable pricing.

And so with that I'll wrap up and thank you for your time.

MR. GRAVELY: Thank you. So we'll save questions until the end and we'll have our last presentation, first, and then we'll have questions for anybody on the panel, that anybody wants to ask.

The final speaker today is going to be from S&C Electric. Let me find your presentation. And Wanda Reder will be talking to us about their efforts. Thank you.

MS. REDER: Thanks for the opportunity to be here. And I also thank you for your attention because I realize that I'm the last one before the big finale. So if you just hang in there for 25 more minutes, I'd greatly appreciate it.

I am Wanda Reder, the Vice President of the Services Division at S&C Electric. And if you don't know who S&C is, we have been in business for a hundred years making the grid smarter.

We’ve been providing switching and protection equipment and building upon the basis for over a hundred-year period, continuing to bring innovation to the marketplace.

I’m going to talk a little bit about the vision of the grid. I know you’ve had two days of that so I’m not going to spend too much time, but I’d like to set a little context, and then hone in a little bit more on the distribution aspect.

Because I have the opportunity to actually see installations and some of the more innovative technologies, I’ll go into that a bit.

Talk about dynamic islanding as it’s coupled with energy storage and then wrap up with some comments on implications for suppliers, users, and also policy makers, because I think that’s really critical as we move forward.

We just heard from GE that the consumer situation is changing and it’s changing relatively rapidly. In fact it is right now the U.S. household actually owns 26 consumer electronic products, so that’s increasing.

I lay this foundation because I think it has an implication on delivery. We continue to have to serve more reliable, it is our obligation to be a reliable provider.

That's driving capacity, but also lays an opportunity where all of the sudden now the loads can be more integral in the overall energy equation.

So if we think about this in a holistic sense I think we can change the paradigm of how we serve, but we have to think about all of the piece parts and how they work together.

This particular assessment came from EPRI and it looks at, you know, is the Smart Grid really green and if so, how much.

Well, estimates actually were put forth that energy savings could be realized on an annual basis of nearly 200 billion kilowatt hours. And to put that into terms that we can relate to that's, you know, upwards of 20 million cars off the road per year. Those are significant numbers.

And granted, a lot of things have to be happened in parallel to make these savings occur. And that's one of my messages here is that any individual piece, in itself, won't do it. I think the pieces have to come together and interoperate.

We need to look at the consumer involvement, we need to look at the end uses, we need to look at loss management, load profile, smoothing, both peak reduction and valley filling. All of those piece parts together end up driving us to where we need to go. Delivery is certainly a piece of it, but it’s not the end all.

Erich Gunther, from EnerNex, actually talked about the vision of the Smart Grid and the characteristics that are established in the Energy Policy Act of 2005 and this, again, kind of summarize them, suggesting that consumers need to be active in it, we need to accommodate generation and storage. Markets become an integral part of where we’ll need to go, along with providing power quality for this emerging digital economy, and on it goes.

I think the most important thing here is that I’m going to now hone in on the distribution part of this overall message.

So the distribution vision within the Smart Grid and where’s it going, what can it do now? I see that we’re moving from a situation where fundamentally we’ve thought of distribution as providing labully (phonetic), and we’ve also thought of it in terms of a normal configuration or as a contingency, first contingency planning.

And I believe we’re moving into an era where we have dynamic generation sources, plug-in hybrid vehicles. We have consumer behaviors that are adjusting, that we’ve known as norm over time.

So I believe we’re beginning to change the paradigm into a situation where the distribution system has to have real-time simulation, has to -- which includes contingency analysis on a real-time basis.

I think that we will bring products to the marketplace that will continue the journey of it automatically adjusting, depending on the situation at hand.

For example, phase balancing. We’ve done some work on self-healing, you know, S&C has provided distribution automation for several years and I think that will continuing to evolve. I think levelizing the load portfolio will happen, not only peak reduction, but also valley filling. Loss management is a part of that, automatic adjustment.

In transmission we’ve heard of congestion management for a while, but I believe it will find its way onto the distribution side. I think that we’ll be able to maneuver around equipment ratings when we start pushing up on them, as long as their ties, and the ability to know that it’s there.

Now, I’m painting a picture that’s pretty far out but, again, I think it’s something that we need to strive for.

And in thinking through this, it really requires the interaction between distribution devices, meters, home area networks, distribution generation, substations, and the like.

Fundamentally, what we’re doing here is asking for various applications to work together and interoperate, like they have not done before.

We need to do this in order to accommodate renewables, and distributed generation, storage. I think that we'll get better at supporting islanding and reestablishing interconnection.

And also as we continue to add these types of technologies onto the system, I see that diagnostics and statistics will become more readily available.

We know that we still are very dependent on people calling to say where there's an outage. And, you know, not all substations even have SCADA.

So what I'm talking about here is quite a bit further down the path than where we are today. Are the technologies available today? Yes, in many cases they are, but they're not necessarily integrated such that they can work together.

Some of the technologies that certainly are readily available, distribution automation, we've had automated metering and that is continuing to evolve. But I think as we look at storage, and distributed generation, and some of our renewables it continues to push us into a situation of evolving and innovating upon what we've done in the past.

Some of the characteristics is this dynamic updating. We talked some about standards earlier.

Certainly, in the distribution area DNP is becoming quite prominent, as is the 61850 in the substation.

I believe that security is going to become more and more of an issue. We're hearing it from the policy perspective, but I think as it begins to take effect in the product side suppliers and users are going to be more and more interested in the security aspects.

On the deployment stage, I think that we need to be able to start small, but also think big. In the experiences that I've had in my career, oftentimes you can get in with a pilot and you can put all the great slides in the world up here, but in the end it's got to be scaleable.

If we're going to, you know, actually realize the benefits that I put up earlier, you know, where EPRI suggested all of these green benefits, we've got to be thinking in a way that these technologies can scale. And that is a different aspect than often is considered in early demonstration projects.

So I would put that out there as a challenge for you as you begin to explore and try the different technologies that are available today.

Communications deserve some time. As we think about the roadmap for Smart Grid, the communication requirements for a meter is much different than that needed in the protection and switching world. In fact, I think of communications kind of as a pyramid, where meters you can get by not talking to them that often, but in the protection side it's got to be fast and it's got to be reliable. We know what's at stake.

So thinking through it, it's very important to have, I think, the whole thing mapped out, otherwise it's easy to end up with different technologies deployed and integrating them later can often be very difficult.

Also, the bandwidth requirements for different applications is a necessary ingredient for early planning.

The capability of prioritizing traffic, also in the communications scheme, is very important, as is the latency.

And there's often, in the distribution side, discussions on is it going to be PIER to PIER, or is it going to be managed from a central location?

My take on it is it's both. There's going to be, you know, kind of a high level of what's going on, but I also am a firm believer that once you get outside the substation fence, as we proliferate more and more devices there has to be PIER-to-PIER communications in order to get the work done, get the operations handled in an efficient and effective way.

It's very, very easy to overload the communications and to get just bogged down from a central perspective to the point that it doesn't work, and also it's easy to add a lot of overheads in the communications outside the substation fence that you just don't necessarily need.

So I lay that out there as food for thought, as you think about these larger deployments as you get outside the substation fence very important for initial planning.

All right, now I'm going to talk a little bit about what we have experienced in some energy storage deployments, some of which was part of EPRI/Smart Grid demonstrations. And again, this is laid out as part of many demonstrations.

On the left-hand side of the slide it says substation feeder, distributed energy resource integration, and there's others, too, that many of you have talked about along the way.

I'm going to talk about the storage one. And it's interesting to hear all of the excitement about storage. You know, as we go into renewables, I don't have any squiggles of wind farm, but we know it's very uneven, it's not predictable, generally speaking it's not there when you need it, and it probably is there when you don't need it. So it's quite obvious the benefits that storage brings to this renewable portfolio challenges that lay before us.

Storage also has benefits that really have contributions to different value streams. In addition to helping on the renewable front, I think that we've seen it being very helpful and cost deferral of new substations. So if you're in a situation where you need to upgrade a transformer you can put in storage, level off the peak, and buy some time, if not a lot of time, depending on the load growth in the area.

I'll talk about coupling this with automation to show how it can also help with reliability, and you can even use it for frequency regulation.

So we have actually installed several -- we, being S&C, installed several here in the last six months. All of these went in, in the November and December time frame of 2008.

And all of these are sodium sulphur belays -- I don't know, is there -- okay, so this would be a one megawatt belay, and in this case there's actually two of them. There's the power control system and then there's a transformer. So fundamentally that's what's going on. There's also a generator back there as well.

And in these cases, like down here, this is a two megawatt, provides 12 megawatt hours of peak shaving, and it's coupled with an island in Samaria that we tied in our distribution automation equipment, a section, a 30-mile long line, 345 KB feeder.

And a similar application up here, this happened to be affiliated with a chemical plant.

This one, everybody's talking about integrating with wind, this is the one I think in the country that actually is installed and integrating with wind. It is actually in Minnesota with Xcel. It's a one megawatt, it provides six megawatt hours, it's tied into a 12-megawatt wind farm and it's at the point of interconnection.

So the fundamental purpose of this installation is to smooth out the wind output and make it more dispatchable.

Those of you that are familiar with Minnesota know that Buffalo Ridge started early with wind. There's a significant amount of wind concentration in the southern part of the state. The transmission system in there is strengthening, however, they do get into scenarios where they actually have more wind output than base generation, and they have seen situations where they have to back off of base generation during white load periods.

So what they're trying to figure out is if they can couple it in the ratios of ten percent storage to see if it can become more dispatchable and more easily integrated in with traditional generation.

So anyway, that's some of what we've been doing with the NAST batteries.

In the situation where we've actually done dynamic islanding, coupling this energy storage with distribution automation, essentially what we've done is taken, you know, our IntelliTEAM which, for those of you that aren't familiar with it, we've had automation products for over ten years, IntelliTEAM has been around for a while. It talks switch to switch and will automatically reconfigure around default to restore as many customers as possible.

Thousands of them are deployed throughout the country and many of you probably are quite familiar with this technology.

What we've done here is taken that technology, coupled it with the battery so that if there is a fault then all of the switches will open, they'll figure out where the fault is, they'll sense the amount of energy in the battery and only close the amount of load that the battery has, that the battery can serve.

And then as the battery depletes, it will release customers off of it to the point that, you know, fewer and fewer customers are served and then, ultimately, it will either restore or it will go out.

So for those of you that like more bubble charts here, we're getting into the real thing. There's a battery down here and there happened to be a fault over here, by Milton Station, and at the point of the fault all of the switches would close -- or open, so that -- I don't know if you can see it very well, they're all open. See that?

All right, and at this point essentially what they're doing, the devices are all opening to kind of qualify the load and figure out how much the battery can actually serve.

And then it begins to switch in, so this one closes in right there, and then ultimately it just keeps closing in until you get as much load as what the battery can handle. And, of course, as it depletes it will start backing up again.

UNIDENTIFIED PUBLIC SPEAKER: Does that communicate to the load to go easy?

MS. REDER: Yes. Yeah. So it’s, yeah, the coordination of that switching relative to the battery, that took a lot of work to get done, uh-hum.

Okay, so I jumped here, so I apologize about that. The next one I want to talk about then is just looking at real solutions and expectations.

It’s so easy to kind of get into the cloud and get the expectations up to here. And I want to step back and just say it’s really important to figure out what we have today, deploy what’s real, and manage expectations so you don’t end up into the trough of disillusionment after you deploy.

And for those of us that have been around this new technology, it’s easy to get the expectations way up, you get off the -- I see a bunch of smiles, you guys know exactly what I’m talking about.

So the point here is, you know, let's be real about what's out there today. There's a lot of functionality, a lot of technology that we can actually deploy and we need to manage the expectations around that.

There's plenty of automation equipment. We came out with a Universal Interface Module which allows this automation equipment to interface with re-closers, to interface into the substation, so it's readily acknowledged that there's multiple parts in the distribution system that's served by us, and others, that need to talk and that's one way to get it done.

I think the comment on the standards discussion earlier, in that we need to think about the interfaces of these applications is really critical. What points really need to talk, what's the data that needs to be exchanged?

One of the parts that is troubling to me is, you know, standards can go overboard easily, where you impose so much overhead that it doesn't work, and you can also restrain innovation. And so I think we've got to balance the innovation part with the ability to integrate and get different applications to talk together. It's not easy to bring both of these forward simultaneously.

The IntelliRupter is our latest technology that's recently released. It's a self-powered device, self-contained; it's a fault-interrupting switch.

What's interesting about this is really twofold. It operates on a patented technology that uses a pulse to sense the fault, so no longer are you putting all kinds of fault current through, it's really a much easier way to sense a fault and take action, as compared to traditionally re-closing which has occurred in the past.

The other thing that occurs is it communicates with its neighbors really fast. And we talked about dynamic protection and the need for it to incorporate, you know, back flow from disbursed generation, and plug-in vehicles, how the protection schemes really need to change and become much more dynamic. That was a discussion earlier on.

In traditional distribution design we've only been able to put about three or four protection devices in series because of the coordination phenomena. And essentially what this technology does is it dynamically can reset the coordination so that you can stack as many of them together that you want.

And ultimately, then, that means that you can decrease the amount of segmentation, reduce the number of customers that are affected, but it also begins us down this journey of dynamic protection, which I think we've all recognized is so important in the Smart Grid vision.

So taking a little breath and trying to figure out what are the implications for suppliers, and users, and policy makers. I think for suppliers, like us, it's important to realize that the game is changing.

I think we need to understand that this dynamic configuration is going to become more and more real. We've talked -- there was some allusion to different planning tools, and I wholeheartedly agree, we're going to have to have -- rethink how we plan and operate these systems.

And I think as it comes down to products and what we deliver, we also have to change the paradigm in order to, you know, work into where the marketplace is going.

Underneath that context it means increased collaboration with others. We've got to figure out how to work with GE and all of these great appliances so that, you know, what's going on in the distribution system can take advantage of the water heater, and the storage. And, you know, those kind of relationships need to evolve and we need to be proactive about forming them.

We need to act now, with the technology that's available, but we also need to figure out and make sure that what we put in the field today can migrate into the future. The amount of money it takes to deploy this stuff is phenomenal, we all know it. So we need to make sure that investment can migrate over time. Forward and backward compatibility is really, really critical, as are the interoperability standards.

You saw the benefits that can occur just by coupling two unlike applications of storage and automation; you get a lot more by just taking those two and figuring out how to make them work.

And I think the interoperability model, we'll learn over time much more that can result because of interoperability.

Security is going to be real critical and so are figuring out how to leverage technologies from nontraditional sources.

I can't help but think it's not going to be long before we have RFID tanks in every piece of switching and protection equipment that, you know, will leave our plant, as well as others.

You know, it takes a lot of work to figure out how to dovetail that into GIS systems. I know from the utility side figuring out, getting that data right is very labor intensive. We need to figure out how to take technologies from other industries and streamline, and make the overall process much more efficient, and there's room to do that.

On the utility side, I think that the process of road mapping and coming up with a vision right from the get-go is really important.

I talked about the ramifications of communications, if you don't do that, you end up with systems that overlay upon each other. It's also easy to implement technologies that don't necessarily interoperate, unless you think it through from a big picture from the get-go.

I think that forums like this, where you can learn from one another on technology, and the assessments, the lessons learned are very important. None of us can do it alone; we have to have the wherewithal to learn from one another.

Demonstration projects are important, but so are large-scale developments and deployments.

Also, you know, continuing to integrate and update those business case assumptions.

And I guess on the policy slide I really didn't make a slide on this, but as I think about storage, as I think about integrating technology into delivery, the home area networks there are a lot of rate-making and policy implications that I think we need to push on and reevaluate because they can become barriers or at least impediments to moving forward.

And I think about when we were vertically integrated, I was involved early in my career in figuring out how to do air conditioning load control, and water heater load controlling. Pretty easy to put the case together for, you know, deferring generation and the customer side.

And now that we are broken up into different segments, it's much more difficult to allocate all of those piece parts of benefit form the various value streams. We know that storage should make it but, you know, if the tests that we have doesn't allow you to take the various parts into account for the benefit, then we need to rethink how we're moving forward from a policy perspective.

And I think that's -- the dynamic protection will bring the cost down. All of this is important. The standards, the integration, bringing the different applications together, we'll get there over time.

So in conclusion, I think Smart Grid is really critical. The grid's here for reliability, it's essential to maintain reliability, as we now have dynamic sources of generation, we have dynamic loads, we're in the cusp of really a wave of change in the industry. And I think it's an opportunity for innovation, collaboration, and also rethinking, you know, regulating, and rate-making. And all three of those really have to go hand in hand.

It requires awareness of initiatives, long-range planning, understanding of technologies available today and also where we're going and, most of all, a willingness to explore new thinking and manage expectations along the way. Thanks.

(Applause.)

MR. GRAVELY: All right, thank you very much.

One question down there I think we have on a blue card -- I think it's right there, we have one card that came up.

MR. GOMEZ: No.

MR. GRAVELY: Okay, thank you very much. If anybody in the audience has questions for any of the panel members, now is the time to come forward.

And I'll see if there are any questions, actually, typed on the internet here.

So does anybody have questions? Go ahead to the mike and make your question, sir.

MR. BROWN: Merwin Brown, CIEE. A fairly specific question, what are the characteristics of the IntelliRupter? In other words, what maximum voltage can it be applied at and what maximum fault currents can it handle?

Because the way you described it, it sounds like a fault current limiter or a fault current controller, and I was curious how it's applied.

MS. REDER: Yeah, I'll get back to you on that. We can go up to 25 KD; we're working on 34.5 right now. And also we are increasing the fault limitation perspective. But I can get you all of the specs.

MR. BROWN: Okay.

MR. REDER: Yeah.

MR. GRAVELY: Any other questions? We have one -- feel free to come down.

We have a couple of questions from the internet, and that is for GE, I'm assuming, "how does the clothes dryer operate on the lower energy state, is it just on/off or a reduction in power use?"

MR. MC CALPIN: In the case of the clothes dryer there are a couple different options. Typically, what we would do is the first option would be to recommend to the consumer that they delay. But if that's not an acceptable answer then it would go into a reduced energy mode. So where we have two heaters in the dryer, we might turn on just one heater which, you know, so it uses half the power during the course of that peak period. It doesn't quite double the amount of time that it takes to dry the clothes, but it stretches it out so you reduce the peak.

MR. GRAVELY: Okay. I'm not sure I understand the last two questions on the board. "Is Big Brother here, GE management?"

Maybe they're talking about the challenges we had with the PCT, where there was a misperception on the customer losing control, but I didn't hear anything where the customer lost control.

MR. MC CALPIN: I guess I would hope that people perceive it that way the key is really to empower the consumers in the world.

MR. GRAVELY: And then “electronics empire, need for secure systems to keep up-time stable, Star Network, Ethernet, or something else supernet.” So I don’t know if there was a question or a statement there.

“GE fuel cells home use, is it available yet?”

Any work that GE’s doing on integrating fuel cells into some of your demonstrations?

MR. MC CALPIN: Not that I’m aware of, certainly not within our business. There could be others within other parts of GE.

MR. GRAVELY: Okay. All right, I see we’ve come to the end of the day and I thank everyone very much for coming. I’d like -- it goes without saying, usually, but I want to say it does take a lot of effort to put these together. I want to thank Pedro and his entire staff, I’ll mention in a second.

Ron Hoffman, who you met yesterday, was instrumental in helping us arrange the conference and getting all the right people here.

I think we had a very successful two-day conference. I look forward to integrating this into, hopefully, we may be able to get a full chapter in the IEPR this year, so it will be provided in draft form. There is still two more weeks for you to provide formal comments into the docket so we can use that information in preparing it.

Anybody interested in participating or reviewing some of our draft documentation, as it is public, so let us know and we'll be glad to share that for comment purposes, if you're willing to do that.

I'd like to also recognize Pedro's team here for helping set this up, David Chambers, and Matt Caldwell, and Jamie, David, Michelle, Elizabeth and Jamie are up there in the back -- our roadies are back there working everything for us.

So with the exception of the audit, everything worked really well the last two days. So this is my first time of using this facility, it's very large, but it worked out very effectively.

Again, thank everybody for coming. Please take the time to send us your comments, we value them very much. It's much easier for us to make comments, if we have comments from the public, and so we like to integrate all those into our presentations.

Thanks to all the speakers, the ones here today and the ones we've had for the last two days, it's been very valuable because of the input everybody got. And I hope all of you get out of this today what you wanted. And in the future we get to put this to work. So thank you and you all have a good day.

(Applause.)

(Whereupon, at 4:20 p.m., the Joint Committee Workshop was adjourned.)

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REPORTER'S CERTIFICATE

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

And I further certify that I am not of counsel or attorney for either or any of the parties to said hearing nor in any way interested in the outcome of the cause named in said caption.

IN WITNESS WHEREOF,

I have hereunto set my hand this 8th day of June, 2009.

Barbara Little

Barbara Little
Electronic Reporter