EFFICIENCY COMMITTEE WORKSHOP

BEFORE THE

CALIFORNIA ENERGY RESOURCES CONSERVATION

AND DEVELOPMENT COMMISSION

In the Matter of:	)	
	)	
2008 Order Instituting	)	Docket No.
Informational Proceeding	)	08-DR-01
and Rulemaking on	)	
Load Management Standards	)	
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CALIFORNIA ENERGY COMMISSION

HEARING ROOM A

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SACRAMENTO, CALIFORNIA

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I N D E X

P R O C E E D I N G S

10:05 a.m.

PRESIDING MEMBER PFANNENSTIEL: Good morning. Welcome to the Energy Commission Committee Workshop on Load Management Standards.

I am Jackie Pfannenstiel. I am the Chair of the Energy Commission and the Presiding Commissioner on the Efficiency Committee.

And to my left is Commissioner Rosenfeld, who is the Associate Member on the Efficiency Committee.

And to his left we are joined by Rachelle Chong from the Public Utilities Commission, who has been our partner in the load management standards proceeding.

To her left is her advisor, Andy Campbell, and to my right is my advisor, Tim Tutt.

This is, I think, the fourth of our workshops on load management standards. Each one has been focused on one issue that we identified as being critically important for the development of useful demand response in California. And this one is on enabling technologies, which we sort of broadly and generally define as those technologies that will help with everything else going on.

Meters and rates and information to bring the demand response to the level that we want it to be and that we believe it should be.

It looks like a very long and busy and meaty day today so I am going to be, perhaps, playing a little harder with the gavel than people are used to seeing here at the Energy Commission. We are usually pretty informal. But we do have a lot to cover. And we have a lot of material that is going to be important to get in front of us on the record, where we up here on the dais, and I think the staff, want to make sure we cover it and that we understand it and that we move along.

So I am going to keep people moving along. I am not going to have a lot of patience for, you know, product pitches. We really do want to get the information out on what's out there in terms of hardware and technologies but we do want to keep it moving so we can get as much information squeezed into our day as possible.

So with that warning and that welcome let me turn it over to Gabe Taylor.

MR. G. TAYLOR: Good morning. My name is Gabe Taylor. I am the project manager for this proceeding.

Before we get started some quick housekeeping. For those of you new to the building there are some restrooms just across the hall, right outside that exit. There are two exits to this room. There is a snack bar on the second floor which you can go to at a break with your visitor badge, you don't need to get badged in.

Also if there is an alarm. And you won't be able to miss it, it will be very, very loud. If there is a fire alarm the exits are over here and the front door here and will follow -- please follow the employees out across the streets. Catty-corner to the park across the street. Thank you very much.

And again to echo the Chairman's statement there. It is a very full day. Please keep your comments on topic.

And I would like to remind you that we welcome written comments at any time and those will be included in the record for full reviews. Thank you.

I will introduce David Hungerford, Dr. David Hungerford, who is the load management standards technical manager.

DR. HUNGERFORD: Does that mean I am also the IT manager? I seem to be having trouble with these these days.

CPUC COMMISSIONER CHONG: That's why we have Gabe.

CPUC COMMISSIONER CHONG: And Gabe, is there a plan when the ceiling tile falls?

(Laughter)

PRESIDING MEMBER PFANNENSTIEL: Run out of the room.

DR. HUNGERFORD: Those have all been -- All of those have been taken down and reglued. Let's just hope that the new, environmentally-friendly glues hold a little better than the old style. All right.

Many of you who have attended earlier workshops have seen some of these slides but there are some additional slides as well. This load management standards proceeding was created to assess -- The purpose of it is to assess rates, tariffs and software protocols and equipment and other measures that would be most effective at achieving demand response. And the result will be to adopt regulations and take other appropriate actions to achieve a responsive electricity market.

The purpose of this proceeding is to obtain public input on potential standards. To explore in some ways the potential of peak load reduction and load-shifting strategies. And then to coordinate with other authorities in the state to make sure that these policies can be carried out effectively.

The workshop schedule. It is the same slide I have been using since the 29th of April. We are moving towards the bottom of it, which is good. We are at July 10 -- We are at June 19 and there will be one more workshop on July 10.

Okay. The objectives of today's workshop on enabling technologies are to understand the policy implications of different types of communication systems and enabling technologies. There are many available and many out there but there are certain policy considerations that we are trying to achieve in using them. And that can affect which choices we as the Energy Commission choose to make.

To discuss the capabilities of currently available near-term enabling technologies and communications platforms. And to obtain public input on the potential use of the Energy Commission's authority to the further adoption of enabling technologies.

Let me give you a brief policy context for this, for this proceeding and for enabling technologies in particular.

The Energy Action Plan, the current Energy Action Plan, identifies a number of demand response action items. Those things that are most related to what we are doing here in this proceeding are clearly the adoption of load management standards to help build and establish a demand response infrastructure.

To facilitate progress on dynamic rate design reform for all customers.

And to approve programs that utilize or to provide input to programs approved at the CPUC that utilize advanced metering, tariff and other automated demand response infrastructure.

There are three necessary components for demand response. You clearly have to have advanced metering so that, so that usage can be measured on at least an hourly basis.

You also have to have tariffs that reflect the cost of service at different times of day. And those tariffs create the incentives to respond. And if properly designed, provide a more equitable pricing by reducing costs to customers with lower-than-average peak usage who are currently subsidizing customers with higher-than-average peak usage.

You also have to have price and event communication to the customers. Information is necessary for customers to take action and the rates provide the motivation to respond.

Enabling technology allows customers to automate that response and make the response and respond more easily and with greater volumes of load.

And certainly larger customers can use price and event communication to hook into automated systems they already have and manage their load more effectively.

The underlying logic of demand response policy is first, reliability. Voluntary price response can reduce the probability of emergency events occurring. Even day-ahead notice of an event can, theoretically if enough people respond even a small amount, reduce the probability of needing an emergency response that next day.

The ISO is already incorporating many of these features in their markets and different kinds of DR products will be -- as we talked about last time -- will fit into those markets to provide different kinds of reliability as well as day-ahead type reductions.

And of course there is always the need for emergency response to deal with true emergency -- system generation failures, transmission outages and other such, other such events.

But demand response can make the need to respond to a supply shortage event less or even eliminate it.

Efficiency. A long-term goal is to improve the system load factor. Time of use and dynamic prices improve customer awareness. The evidence is quite clear from studies across the country. And improve the ability of customers to manage their own usage.

Attention to load shift strategies by all customers, the evidence is clear -- large customers as well as small -- reveals potential for efficiency improvements that people otherwise would not be aware of or would not have paid attention to.

Another policy issue is demand response can reduce costs and reduce bills. Including demand side options does create downward pressure on supply prices. And the ISO markets are clearly reflecting an attempt to try to create a possibility of doing that.

And reduction in the peak load growth rate, which is currently growing faster than total consumption, delays or eliminates the need for generation and transmission investments solely to meet peak load growth. There are clearly other reasons to improve the transmission infrastructure. But certain investments made solely to meet peak load growth would be avoided and that is a source of cost reductions.

Other major issues, energy conservation. Price differentials drive changes in consumption behavior and customer expectations for when and how they can use power.

The experience of peak reduction, it is clear from experiments and pilots, leads to spill-over energy conservation. Probably through the mechanisms I described earlier where the awareness of paying attention to one's consumption in a more careful ways reveals waste or reveals unnecessary consumption.

And ultimately if we are reducing kilowatt hours we are reducing, we are reducing greenhouse gasses. And that fits, that's the place that demand response is in, in an overall AB 32 greenhouse gas reduction strategy.

There's also another potential benefit that is being explored now and that is for using dispatchable demand response to help balance renewable generation. Which could, in theory, increase the amount of renewable generation that the system can use.

Okay. The underlying principles for the future of demand response. And this is a staff perspective, it is not official Commission perspective at this point.

The first one is Commission policy and it has been for 15 years. Customer choice. Dynamic rates accompanied by adequate education can give individual customers the opportunity to choose which end uses to shift or avoid. Implicitly expressing the value they place on their specific end uses.

Economic efficiency. In theory we would prefer people to drop the lowest value load off the system rather than the highest value load. Currently many of the demand response programs go after, because it is easier to get because the costs of getting it are less expensive, go for high-value load. On a very hot afternoon residential air conditioning is a high-value load. Industrial production is a high-value load.

We would rather first facilitate the ability to reduce low-value loads off the system. Squeeze out ways to find uses that people can do without during periods of need before we start asking people to reduce their comfort or reduce their productivity.

Small amounts of demand response from a large number of customers may well be the best way to achieve economic efficiency cost reductions and customer choice. A little bit from a large number of customers gets the same amount of demand response as a small amount from a small number of customers and costs less both to the customers and the compensation the customers would have to get to reduce that load.

And of course automation. And this is the segue to today's workshop. Automation makes response easier. Economists use the term transaction costs to refer to two things. The cost of taking the action. Picture a residential customer having to walk over to adjust his thermostat. There is a cost, there is a hassle involved there. The other is the cost of paying attention to making sure you know it is an event day. Those costs for all customers are reduced with automation.

And with that we will move on to our next speaker, who is Roger Levy.

MR. LEVY: Good morning Commissioners and staff. I am going to make a presentation in the next few minutes and provide you with two things. One, a brief history of demand response, because I was asked to do that.

But I want to put that history into context because the foundation for demand response originated, and how it has evolved, actually became the basic foundation for the research that has been going on between the Energy Commission, the PUC, what once was the Power Authority, and the Demand Response Research Center, for the last six years.

And I am also going to try to demonstrate how some of that research and some of the initiatives have been bearing fruit. And where we stand with that research and what is left to be done.

So what do customers want? And what I wanted to start with is that the interesting aspect about this whole presentation is that it was based, in part, on the vision statement coming out of Working Group 1 that was appropriately titled, Demand Response 2008, a Vision for the Future. That was done in 2002. Six years later I guess this is where it starts to begin.

So what I wanted to lay out first is that we started with these four criteria. What do customers want? I want to take off from where David Hungerford left off. That the basic premise for all the research started with the issue of customer choice. And so the best place to start with customer choice is determine what they want.

A lot of this work came out of research I am not going to go over that came out of the outages in 2000 and 2001. I am going to try to spend more time on some of the more substantive issues.

Let's start with the evolution of demand response. And I apologize for the busy graph.

Demand Response actually began in the 1930s with Detroit Edison and some water heater tests, water heater programs. It was meant for building load, not reducing load. And they used time clocks rather than any other kind of control because that is all that existed back then.

But their goal was to build off-peak load to compete with gas and other fuels and to basically provide customers a separate rate for water heating. Some of those separate rates, some of those time clock controls, actually still continue to exist in the US in other parts of the Northeast.

But in the 1950s those water heater time clock controls began to be replaced with analog radio, FM-types of switches. And those analog radio, FM-switches have actually continued to exist through today. There are many utilities in the Midwest that continue to use the same technology that was first introduced in the 1950s. A lot of those switches, tens of thousands of them, are now in a position to be replaced by those utilities.

The goals of those programs in the 1950s also changed a little bit because then the electric industry was very successful in building load. So the water heater time clock programs evolved into the late '50s, early '60s, to become the first peak load reduction programs.

Air conditioner load control also began to be introduced in the late 1960s, early 1970s. Arkansas Power and Light was one of the first companies that had an air conditioner load control program.

They were based on the switch capabilities, which is digital controls. The digital signals activated a control switch. So the issue of customer choice was very simple. The customer could participate or not. If they didn't like what was done their choice was to drop off the program.

And the programs basically were driven by participation payments. It was a very practical reason why it was done this way. Participation payments allowed the incentives to be kept out of the rates. Rates normally went through a different regulatory process or review process by the local boards. Keeping the payments out for programs which the utilities considered to be somewhat tentative or experimental at the time was a very prudent choice.

But unfortunately this same structure actually continues to exist, even through many of the California utility programs to date. So based really on the format driven by analog technology introduced in the 1950s.

Starting in the late 1980s the first digital technologies were first introduced. And digital technologies provide a different format than the analog. Digital technologies provide, have the capability to provide information and information can be provided to the customer.

And the first example of that is probably the Gulf Trans Text Critical Peak Pricing Pilot, which began in 1991. It was the very first introduction on a larger scale of critical peak pricing. And it introduced the concept of what we call today the programmable communicating thermostat, in application. It introduced the first major program with customer choice. And it introduced the issue of integrating advanced metering with thermostats, rates and customer choice. And that was basically based on the first introduction of the digital, again, the digital technology.

Further, in 2001 Carrier came out with what is considered to be the first, major, mass-produced, programmable communicating thermostat. That technology continues to be used today. The biggest example of the change is the statewide pricing pilot that took place as a joint effort by the PUC, the Energy Commission and the Power Authority starting in 2004. And that employed basically the same technology and the same approach as the Gulf Power Pilot, which was price responsive, customer choice, information to customers and AMI integration.

Today we have a number of different digital technologies that are available. The technology field is actually very ripe. I am going to describe a little bit more about the evolution of some of the research that is taking place in California, as I go through this, to fully illustrate where we are today. Eventually I'll get these buttons right too.

This is the vision statement that the Demand Response Research Center and the Energy Commission through the PIER program have been working with for the last six years. Basically the fundamental pieces are demand response and energy efficiency integrated from the beginning. We believe that is best done through the rate. That is also a customer issue because from the customer's perspective it is really difficult to differentiate demand from usage. A kilowatt and a kilowatt hour go hand in hand.

The equity issue. Why shouldn't all kilowatts at two p.m. on a hot summer day be valued the same, regardless of what kind of end-use it comes from.

The third point is that there is a need to make demand response more cost-effective. And one way to do that is to reduce the cost of demand response and the cost of the equipment. And I will illustrate with a very clear slide at the very end of the presentation how the research is leading to that point.

And last is that demand response and demand response impacts, and the most effective impacts come when you implement customer choice.

So today, our view back in 2002 was demand response is really a pretty limited resource. A very simple, sort of Consumer Reports type of chart where we were comparing direct control with price response.

And from the initial perspective it looks like price response provides more customer choice, more economic response.

The ability to integrate economic and reliability.

The sustainability issue comes in because with customer choice, if a customer doesn't like a particular strategy, since they are the ones that set it, they are the ones that can reset it. They don't have to decide whether to participate or not participate any longer.

And from a cost standpoint I am going to illustrate how combining all these actually reduces the cost of demand response.

This is an expansion of those same characteristics. Today the demand response is basically characterized as separate programs with separate incentives for each program.

It's pushed into the market. And by that I mean utilities are actively, aggressively marketing demand response programs to customers.

It is principally focused on generation and reduction in peak.

And it is designed traditionally for the utility and not the customer. And from that perspective what I mean from that is that the utilities like reliability and control and so they actually prefer direct control over a price responsive-type of strategy.

The vision that we work with is that demand response should be a system-wide resource, an integrated resource.

It should be market-driven. And that all customers should have access to demand response.

There should be wholesale-retail integration.

That demand response should be used both for generation and distribution management.

And also, simultaneously if possible, for economic and reliability, and designed for the customer.

So all I want to point out with this particular slide is that the model we have actually chosen for pursing demand response is the same model employed for the efficiency standards that the California Energy Commission and the Public Utilities Commission have been implementing for the last 20-plus years. Which is, make demand response available to all customers, focus on the value the customer assigns to demand response.

To emphasize a point that David Hungerford made, the customer is in the best position to decide which of the lowest value loads. And by giving them customer choice they are in a position to make those loads available, if they deem that they are cost-effective for themselves.

That the customer should really own the demand response. That one way to reduce the cost of demand response and the cost of the equipment is to introduce many suppliers to the market rather than a few suppliers. And utility programs tend to have a very limited number of suppliers.

That customization of the strategies and the programs should be done by the customer and have no limits. The customer should be able to customize a program to whatever they deem is appropriate for their facility.

The incentives should be performance-based. And like energy-efficiency incentives there is a need not only for performance-based incentives but there may be a need at the beginning or start-up effort to provide purchase or other incentives to overcome initial barriers.

And lastly, the key problems that we came up with, with demand response. I have highlighted rate on this issue. That problem has actually been partially removed by a recent PUC decision.

So three things that we focused on in the research the last six years. David Hungerford has gone over all three of these already. I am going to go over one of them in particular at the very bottom in a little more detail. Advanced metering, dynamic rates and automation. Those we felt were the three critical factors for the success of demand response.

Thing 1, advanced metering. This is a fairly self-evident answer at this point. System-wide metering with communications and interval recording. And the reason is because it provides information, both for the customer to manage their load and to educate the customer, not only for demand response but for efficiency.

To support rates, new rates, like the dynamic pricing the PUC recently ruled on.

And to provide the integration with the system that is necessary to provide interval data at a system level that can be integrated by the

ISO and the system dispatch.

The dynamic rates. Reason? To reflect system costs.

And the other reason is, why we need dynamic rates. It establishes a value function for the customer.

It provides price signals for economic response.

It provides reliability signals for emergency response.

And it provides customer choice.

And it turns out that when you integrate the dynamic rates, the metering and automation you wind up getting the ability to integrate reliability and economic dispatch at the same time with the same customers and eliminate a lot of the barriers to demand response.

This is some of the research. We have gone over, I think in a prior proceeding, a prior Commission workshop on load management standards, you had a presentation from Ahmad Faruqui. He went over review of the prior results from a lot of the critical peak pricing and dynamic pricing tests from all over the country. We were very actively reviewing that material.

In fact Brattle, the company that Ahmad represents, has been working with the Demand Response Research center for the last three or four years. We were very privy to that information. We have been in contact with most of the sites that had those prior tests. That factored in to what I am going to illustrate. But what I am going to focus on and illustrate is a lot of the material from the California Pricing Pilot.

So what this illustrates is customer response to price. And this came out of the Statewide Pricing Pilot in 2004-2005. What we saw that on the left side of the graph, that while time of use rates are effective in reducing demand on a limited scale, critical peak pricing produces a much stronger response. Not just for residential but for commercial/industrial. This is a small commercial/industrial representation on the right side of the graph.

We also found that all customers respond to price. All customers had the capability to provide demand response. Some customers, low users, are obviously going to provide a lower amount of demand response, a lower kW. But the still provide almost equivalent percentage reductions as all other groups.

So the results from the Statewide Pricing Pilot basically confirmed to us that all customers had the capability to respond, all customers had the desire to respond if presented with the right price, automation and the opportunity.

The third part, the automation part. Which I am going to focus on for the remainder of the presentation. Why automation? It enables and simplifies customer choice.

It enables price and reliability response. And what I am going to illustrate with the commercial/industrial work the Demand Response Research Center has done, is that it enables that response simultaneously with the same system, which substantially increases or could increase the value of demand response, which s currently today limited by artificial program boundaries.

Finally, automation allows demand response to be integrated with system operations.

So here is an example of what happens. It's the same chart that I presented before that came out of the Statewide Pricing Pilot. And the objectives of that pilot were very deliberately designed to look at these issues. This is not looking backward and finding things that were artificially or accidentally complementary to our objectives. This was part of our objective all along since 2002.

But what you see is that from a time of use rate of response, about four percent on that first year response in the Statewide Pricing Pilot, that without automation and just price as a difference that the demand response increased substantially to between 12 and 13 percent.

When you add automation it doubled again to about 27 to 30 percent. That in fact has been the case with every single pilot that has been done in the United States for the last five or six years.

And finally, the question came up, how reliable is demand response for real critical days. And that's the bar on the far right, out of the Statewide Pricing Pilot as well. And you can see that on even the worst day of the year the demand response was even bigger than on the average for the rest of the year.

I want to illustrate with this graph,

illustrate the difference between the price, when you combine price and automation and customer choice with a conventional demand response program. So you have to think back to that Consumer Report chart that I put up which had the little green and pink bullets on it.

The blue line represents -- This is data out of the San Diego programmable communicating thermostat pilot that the PUC ordered them to do for residential customers. The blue line represents the base, residential average load for the group in the pilot.

The green dotted line represents what the load looks like for those customers who were on programmable communicating thermostats who were on a fixed participation incentive. And what it shows is, those customers reduce load about one kW on average for this particular day type.

What the orange line shows is that in year two of the San Diego pilot we took a sample of customers out of that pilot and all we did was change one thing. We took them off the participation incentive and put them on a critical peak tariff. And what the orange line shows is the load for those customers more than doubled from what the customers on a conventional program were doing. We have also seen this same effect in commercial/industrial.

For small commercial, small commercial/industrial, same exact result. You put technology in, give them automation to automate their load response, and the load more than doubled from roughly 6.6 percent to -- between 5 and 6 percent to 10 to 13 percent.

And I don't know what happened with this graph. This changed between the time I gave it to the Commission and now so I'll skip this one and go to a different one.

I want to highlight now similar sets of results with the same combination of factors, which is critical peak pricing, or pricing, automation and customer choice. This is results from what's called the AutoDR set of pilots that the Demand Response Research Center has been conducting for the last five years. And this is a summary of the 2007 results, which is the first year of what we considered to be the first stage commercialization that the PUC ordered the three investor-owned utilities to do as a result of an order coming out of the 2006 Emergency Orders.

And what it shows, what you really want to look at is the very bottom, right-hand side of the graph. What this graph shows is that we have covered commercial, large commercial, large industrial, small commercial/industrial customers. And that the aggregate -- this is aggregate load reductions for -- peak load reductions for these customers as part of an ongoing, one-year implementation.

And the load impacts are far in excess if what anybody had ever expected. I will better illustrate that with some of the other graphs. To illustrate the sustainability of these impacts the Demand Response Research AutoDR pilots have been going on for about six years now. This is a five year comparison. This comparison plots similar customers over the entire five year period. And what it shows is that on average the large commercial/industrial customers will reduce in load somewhere between 10 and 13 percent.

The context to put this in is that nationally these same customers are not considered to be very good candidates for demand response. Nationally the typical response that is received on demand response programs from other utilities is somewhere in the range of four to six percent. And so this type of response, the 10 to 11, 10 to 14 percent, has been going on for six years in California when you combine the pricing, the automation and the customer choice.

In these programs the customer chooses what to do at their site. The automation is using the customer's energy management system. And for these customers, these customers were all on, except for the first two years, which was a proxy, these customers are all on PG&E's critical peak price -- critical peak rate.

This is a traditional comparison for those same customers. This is the non-industrial, this is just commercial customers. And what it shows is that -- two things. One, it shows that when you put a customer on critical peak pricing with automation that they obviously reduce their demand. But in the commercial case, they also save energy.

And in fact, some of the evidence from the work that's been done at the Demand Response Research Center is that the process the customers go through to decide how to respond to a critical peak price, how to automate their EMS system to make that response, is that in several cases the customers have identified tactics that they can use every day and reduce their demand permanently and they have. One of the customers that has done that has been the IKEA store in West Sacramento.

So to emphasize another point that David mentioned. That when you proceed with demand response on a customer choice basis with the right price signals and the automation, that it has ancillary benefits, very clear benefits in some cases for efficiency.

The AutoDR is not a technology. Again, it's an information packet that uses digital communications to communicate to customers price and reliability signals. And so part of the work for the Demand Response Research Center has been to look at other kinds of demand response that can be supported with automation and price.

So this is an example of results from auto-demand bid programs by utilities. And for the 2007 year there were 11 sites participating. And the auto-bid programs basically responded with about 98 percent of the load that was bid was actually delivered into the system when it was called. Again the average within California, if you look at the monthly reports the utilities file, is that the delivered versus bid generally tends to be in the 20 to 40 percent range. Ninety-eight percent is obviously quite high.

This is an example of a comparison of why we believe automation and price go hand in hand. This is a comparison. The red dots represent customers on critical peak pricing in PG&E service territory, with the AutoDR. In other words, receiving a digital information packet that is giving them the price and event signals. The blue triangles represent a comparable group of customers in PG&E service territory on critical peak price without AutoDR.

And what you see here is a very large gap. The customers without AutoDR basically had no change or a minor increase in load during the peak. And the customers with AutoDR reduced their load, on average, over eight percent. A very clear demarcation and an indication of the value of this type of approach.

So there's several things I want to point out with this graph. What this basically shows is a summary of the 2007-2006 data. Excuse me, the historical data from AutoDR, which shows about a 13 percent reduction in peak load.

What this graph doesn't properly highlight, though, is these same customers, once they automate, have the capability not just to reduce on-peak, but they also have the capability to reduce, for a short duration, additional reliability response.

And in fact, the middle column here called Non-Coincident Maximum kW Reduction adds up to about 1500 kilowatts of load. Which represents about 21 percent reduction in system peak.

And so in fact these customers had the capability, and some of them have done this already, the capability to program their systems to respond not just to a day-ahead economic signal, but also to respond on a day-of basis to an additional reliability signal.

The benefit of being on a dynamic price is that if the price is properly structured, if the rate is properly structured, there is no baseline problem. There is no double payment, there is no overpayment problem. Because the customer basically just pays for the load they consumer or the load they use at a given time.

So what we are basically trying to

highlight, both with the AutoDR program and with the automation, which was an original design objective that we had, is that with the proper combination of dynamic tariffs, with automation and customer choice, some of the artificial boundaries in the existing demand response programs can be removed.

By allowing the customers to respond both on a day-ahead economic and a day-of reliability there is no additional requirement for new equipment on the customer's site. So obviously, if the customer gets additional benefit out of that response their cost-effectiveness goes up, the utility's cost effectiveness goes up, for no additional investment.

And the most critical piece is the number on the far right, $57.62 per kw. That is the one-time cost customers incurred in this four-year implementation period to put in AutoDR and to automate their facilities. There is a minimum cost ongoing year to year to maintain that system because it is part of their existing energy management system.

The last results that are not depicted on this chart is that for 2007 implementation the following costs were observed and are a part of an analysis that the Demand Response Research Center recently completed. And that is that the average cost for a greatly expanded population of customers, which included industrial customers for the first time, was pushed up to about $71 a kW, the one-time cost.

The range of costs was $8 a kW for commercial buildings that had EMS systems, for legacy systems, up to -- The highest cost was about $118 per kW for new industrial customers. So the new industrial customers are what drove the cost from $57 to $71. But we found that with going into commercial customers with legacy EMS systems and a familiarity with their system, that the cost for going to demand response was as low as $8 a kW.

And now we come to the punch line.

PRESIDING MEMBER PFANNENSTIEL: Um.

MR. LEVY: I'm sorry. Jackie.

PRESIDING MEMBER PFANNENSTIEL: Before you go to the punchline I just want to make sure I am looking at the one-time costs for setting these things up. I am looking back to see if you showed the savings to these customers.

MR. LEVY: No, we did not show the bill savings the customer had.

PRESIDING MEMBER PFANNENSTIEL: Right.

MR. LEVY: I can tell you what those are. We didn't depict them on this graph.

PRESIDING MEMBER PFANNENSTIEL: The question, of course, is one assumes that they are saving more than their one-time cost.

MR. LEVY: Yes.

PRESIDING MEMBER PFANNENSTIEL: But what is the average payback and how long does it take?

MR. LEVY: The average payback and the actual bill savings is very much dependant on the rate. The same customer load-shape change in PG&E on a CPP tariff, and in Southern Cal Edison on a CPP tariff, will produce a difference of about -- a tenfold factor difference in the bill impact.

For PG&E, because of their rate design, the average savings to the customers for this sample for this time period, was about a one percent reduction in their total, annual bill.

ASSOCIATE MEMBER ROSENFELD: But could you turn that into a payback time, Roger?

PRESIDING MEMBER PFANNENSTIEL: Payback?

MR. LEVY: I don't have a payback time

for that. What I know is from the customer standpoint, because they used their existing EMS system, the actual costs here -- you can see the costs are very small. The bills for these customers are very, very large. In most cases the payback for these customers is less than one year, even with one percent savings.

PRESIDING MEMBER PFANNENSTIEL: Because of course -- I mean, these look good to us. Although $58 a kW depends an awful lot on how many kWs you use. But the question is whether the customers will stay on this program. And they'll stay on it if they are saving money on it.

MR. LEVY: What I can tell you is that there have been no customers that have left the AutoDR facilitated program except to move to a different DR program offered with different, more beneficial incentives, by their host utility.

PRESIDING MEMBER PFANNENSTIEL: And this is for how many years, four?

MR. LEVY: This program has been operating for, now it's into it's sixth year.

PRESIDING MEMBER PFANNENSTIEL: Thanks.

MR. LEVY: One of the objectives that I mentioned at the very beginning was moving toward automation, including price response. What I want to highlight here is that the discussion that I have just gone through is identical for residential as well as commercial/industrial. We had the same objectives for residential as well as commercial/industrial.

And I will use the commercial, programmable communicating thermostat as an example of how moving from analog to digital and moving toward many suppliers from a single supplier, or from a few suppliers, and moving to large markets, making demand response available to all customers rather than a narrow, targeted, marketed sample.

Commercially available, programmable communicating thermostats, have been available for about seven or eight years. The first one was introduced in 1980 by Honeywell but the Carrier thermostat was the first one to really make some major market share.

Honeywell, with White Rodgers, also provides commercial, programmable communicating thermostats. Those devices range in price from about $225 to $350 apiece depending on how many you buy, who you buy them from and what you intend to use them for.

The CEC PCT evaluation that was part of this research plan used a $150 benchmark as what they thought would be the logical, wholesale price for programmable communicating thermostats, if, in fact, we could develop a standard reference design and an improved market for demand response.

That's the second block. That's the second block right here, the CEC reference design. So the cost-effectiveness analysis done two years ago assuming a $150 price point. That cost-effectiveness proved to be positive. So the CEC went ahead with the development of the reference design for the PCT based on that conclusion.

What we have today is that conventional air conditioner load control switches, which is this little item on the bottom, they generally will sell for about $75 to $100 apiece. They are in wide use by lots of utilities, including California utilities.

They are subject to a lot of factors that affect their performance. I am not going to go into many of them. Although one of the factors is that because of the nature of that device the utilities, once they install them, really have no idea whether they are still working or even in place. And because air conditioners have a useful life of maybe 13 to 15 years, that a certain percentage of air conditioners and their switches wind up in a landfill somewhere every year, unbeknownst to the utility.

What we determined from some of the initial work from the reference design is that that $150 price point that we originally speced for the cost-effectiveness analysis two years ago actually turned out to be a little too high. Ron Hofmann I think will go into a little bit more detail on some of this. Is that what we have heard from the industry is that the price point will actually be somewhere under $100 for the new reference design programmable communicating thermostat.

So as far as the objectives we have been able to try to accomplish is that the PUC has introduced default dynamic pricing as part of a proposed decision two weeks ago. The Energy Commission and the PUC have successfully introduced advanced metering and two of the three investor-owned utilities and one is pending.

The third piece has to do with

automation. The AutoDR approach, the information model. It's a digital packet. It was submitted for a national standard last month. It is in the process of being reviewed on a national level right now and it's also received a lot of interest from both Europe and from other utilities around the country.

The programmable communicating thermostat was a residential component to that research plan. And as everybody in this room knows, that is still pending and awaiting a later review to address a number of other concerns that came up as part of the public comment.

And that is the conclusion of my presentation. Any questions?

PRESIDING MEMBER PFANNENSTIEL: Further questions? Tim, did you have anything?

ADVISOR TUTT: Yes, I do have one question. Regarding AutoDR. You describe it as not a technology, as an information packet. But my question is, the information packet has to have some technology or equipment at the customer site to receive that information and actually do something with it. And that would be a demand response automation server or an energy management system or something like that. Can you elaborate on that?

And also the second question is, you said there was a -- it had been submitted as a national standard. where and what is the status or progress or prospects for that?

MR. LEVY: In answer to your first question, there does need to be a way at a customer site to receive that information packet and do something with it. For commercial/ industrial sites, for large commercial/industrial sites, the energy management system is the candidate for that. For new energy management systems, most of them come factory-ready to accept digital signals from outside sources.

So in fact the low cost of $8 per kW for the commercial customers in 2007 to implement AutoDR was a result of all they had to do was make some software changes in their EMS system. They didn't need any new equipment to receive those digital packets. They received the AutoDR signal as part of the standard. It's basically an Internet protocol-type signal. Standard, open standard. There's nothing proprietary about it. And in fact it was tested both with individual customers and aggregators and it worked successfully with both.

For new commercial/industrial customers that don't have EMS systems then new technology will be required. Some form of control switch or some other controller will be required to receive that signal.

PCT was actually envisioned as a device for doing that for small commercial/industrial. And for residential the PCT was envisioned as a vehicle for doing the same thing for residential. To provide the first level of automation. If you want to call the PCT essentially the every-man, beginning, home-automation system, that's what it would be.

The second question in terms of where AutoDR is being introduced. It's been introduced before BACnet, which is a building automation representative group. NIST is also looking at it. It's been taken before a number of other regulatory bodies. I would be more than happy to provide a full list of all the different standards-bearing bodies that are reviewing it.

It is also being considered -- There is discussion going on as to whether to introduce it through IEEE as a standard. Part of the problem there is the time frame it takes to get some of these things through.

In terms of the reception. It's had a very positive reception. It had a day dedicated -- there was one day dedicated as part of the Connectivity Week conference that was held in San Jose last month. And it received extraordinarily positive comment and review from all the people who attended.

And in fact AutoDR was given one of the awards at the conference as one of the innovative advancements for demand response for that year. Does that answer your question? Thank you.

PRESIDING MEMBER PFANNENSTIEL: Andy.

CPUC ADVISOR CAMPBELL: I understand there are a number of private sector demand response providers which do provide automated demand response in different forms. I wonder if you have any sense, from a numbers standpoint, of the types of load reductions and costs that various private sector demand response providers have seen?

MR. LEVY: The Demand Response Research Center and PG&E and Southern Cal Edison and San

Diego worked with a number of those providers as part of the 2007 roll-out. EnerNoc was one of those providers. We don't have any information on what costs they see from their customers for implementing automation. Those are generally proprietary numbers.

In terms of the demand response they get. That's also driven in large part by the contracts they sign with the utilities, of which we don't have any information. We are not privy to any of the contractual terms. And the demand response impacts are driven pretty much by the baseline standards or baseline elements of those contracts.

What the aggregators tend to do is they will balance off the loads or the demand response among the group of customers to achieve the baseline requirements. So they work on a group average. The AutoDR work that I reported here was on individual customer site bases, which would be quite different. I'm sorry, I can't give you any information on what the aggregator -- what their costs are or what they do.

What I can tell you is that the aggregators have all, none of them have any problem with the AutoDR information packet approach. But what all the aggregators generally tend to do is they have a proprietary communication, proprietary information packet that will go from their server to the customer's automation that they happen to be managing.

PRESIDING MEMBER PFANNENSTIEL: Commissioner Chong.

CPUC COMMISSIONER CHONG: I have three questions, I guess. The first question is, is there information about AutoDR programs that are being run by the publicly-owned utilities?

MR. LEVY: As far as we know there are no publicly-owned utilities that are using AutoDR at this time.

CPUC COMMISSIONER CHONG: My, my. Communications costs. I saw in one of your early slides, evolution of DR technology and programs, that there's some new, promising communications technologies that have finally evolved to the point where they may lower some of the communication costs. WiMAX, for example, RCS. Do we believe that some of these new communications technologies may reduce costs for these types of programs?

MR. LEVY: I'll give you two-part, two answers. One is I am going to let I think Ron Hofmann in his next presentation addressed more of the cost issue rom our perspective at the Center. The communication cost was not a significant element in pursuing this.

At least the AutoDR that was implemented at most of the utilities in California was done through the Internet. So if there was an Internet-established connection at the site there was no additional need for additional communication expense.

The other technologies that were mentioned in my slide, and that you mentioned, are also capable of providing the same information packet. And the costs are very dependant on who implements it, how they implement it and the number of customers that it's implemented for. Some of those -- Some of those technologies will have individual customer costs, some of them won't.

CPUC COMMISSIONER CHONG: Okay. As I was thinking through this AutoDR part particularly I was thinking about the impact that the California ISO MRTU would have on these types of programs. I know that it is important to the ISO that they get as much day-ahead information about demand response programs as possible, for obvious reasons, as opposed to day-of programs. So I am wondering to what extent you might have advice to us about how to proceed as MRTU gets closer.

MR. LEVY: There are a number of options for doing that. One is that there is work going on at the Lawrence Berkeley Labs with a program run by Joe Eto under CERTS where they are actually working directly with the ISO and with Southern Cal Edison and Southern Cal Edison's air conditioner load control program to provide the exact information that you just referenced.

Where that program has provided a reference of basically an access point from feeders at the Southern Cal Edison sites where air conditioner load control is being run to display units at the Cal-ISO. Which lets the Cal-ISO view pretty much in real time the status of the demand response programs and what's happening in any given moment in time.

There is another interpretation to part of the question that you asked and it has to do with how do you incorporate the MRTU pricing in some of this. That's probably more of a rate design issue. And maybe I'll call it the simple, naive response would be to separate out the wholesale costs that are currently embedded in the retail rate and replace with the hourly MRTU cost.

So for customers on -- In a real-time pricing example, if the wholesale cost that is built into the retail rate was replaced with the MRTU cost you would now have a much more, a much more accurately defined, real time price that would reflect both the retail and the wholesale cost simultaneously.

For a critical peak tariff there would obviously be some averaging that would be necessary to make it compatible with the rate form.

PRESIDING MEMBER PFANNENSTIEL: Any other questions? Thank you, Roger.

MR. G. TAYLOR: Thank you, Roger. Next I would like to introduce Mike Gravely. He is the Energy Systems Research Office Manager in our Public Interest Energy Research Program.

MR. GRAVELY: Good morning. What I would like to do today is just give a brief perspective on the research you are going to hear about today. The enabling technologies and how it fits into the emerging technology picture that we are working on for the full system.

I think from today's workshop there are several outcomes from the research and development side that will be -- And I want to be sure that people who are attending and on-line understand there are some options in this area that they should be aware of for today's agenda.

One is we are looking for clarification and better understanding of the emerging and enabling technologies, specifically in the area of demand response and those types of areas. I will talk about much broader areas than that.

We are hopeful that future load management standards will evolve out of this and the R&E that we worked on will migrate closer to a commercial area then to a standard area.

Also there are quite a few topics that may come up today and it may be areas of interest that we are not able to cover. And I will simply make an offer to those that are participating and those that desire that I certainly represent -- for the Commission here I am more than willing to hear presentations and hear information as topics come up.

I would prefer you provide those in writing so they can help in our future references of doing research and development. Use this information as we develop future research plans. So there may be topics that come up, there may be areas that are of interest, but not necessarily fitting the scope of this workshop. If that is true then the scope of our work is much broader than that. I would encourage you to contact my office or individuals in the Commission here.

As we do emerging technology we are looking at the full spectrum. I will take one second here, Commissioner Chong, in answer to your question about MRTU. Our office, and myself in general as well as the working groups, are looking specifically at the MRTU implementation. How it affects the system, how the DR products and services that are being developed will be implemented and integrated into the MRTU and how those services are best applied to California.

In addition to what you hear today there are other working groups and other activities that are ongoing, specifically drafting the MRTU implementation of demand response. Particularly, hopefully AutoDR and other types of products like that, that are more conducive for that type of support.

For those who are listening and not here, we do work in transmission, distribution, integration across the grid, as well as the consumer or customer side of it. You will see many things today in the area of communications and control of those technologies that have cost-cutting value. And so they can be applied not only in demand response but distribution automation, grid reliability, grid security, other areas like that. So we do look for those types of things.

And one of the values for us is these technologies are implemented in one area. In many cases there are able to be applied to other areas that very low cost because the cost of implementation has already been covered by the first project.

The Commission publishes an Integrated Energy Policy Report and the last one that was published did point out the grid of the future concept. So today you will see on this chart here several areas of DR, but you will also see things like distributed generation, storage, renewables, integration, and a whole system of a grid that communicates not one way but two ways. So again, as part of the effort we are doing today, the future emerging technology will be addressing how these things will fit into the system of the future.

A couple of quick, just some examples for you of technologies that we are working on that have the same type of impact as what we are seeing today. The transmission area, phasor research is one of the more exciting areas we have. We are getting to the point where the ISO will be able to see, and a utility will be able to see their information 30 times a second as opposed to once every four seconds. And as a result of that we are kind of creating not only technology but displays and ways to use that information across the grid.

In the area of the distribution side, distribution automation. In addition to automating demand response there's lots of other automation that will improve reliability, improve the performance and reduce the cost of the grid system of the future. So these technologies that you see today and others are used specifically for those objectives.

You will hear a lot today about AutoDR. I want to just point out a couple of things. And one, you'll see this chart here which shows you that in addition to demand response we are getting efficiency savings and we're getting it when we really need it.

I think it is important to point out for the definition that we work with, automation of demand response means that the customer selects -- whether it's an industrial, commercial or residential customer. The customer is given automation but the customer selects which part of their load they're interested in automating for demand response. And then that is set up automatically for them so they do nothing if they want to go forward.

However, the customer always has the ability to change their mind. The customer can choose to not participate in the particular event. Or if the event is occurring and they want to change their mind they can change their mind during the event.

The technology today, we feel, allows

those choices. What we find is very few customers choose to change their mind but most customers, once they have done the selection process, continue with the process they have selected.

The other thing we are learning from a research perspective is that these customers begin to know their load better than they did before. So in many cases or in most cases, in addition to demand response we're getting pretty good efficiency improvements from these customers in addition to demand response.

As we mentioned before, I'll mention here about the work with LBNL. Once the system is in place then we are able to use that system for other services. And customers who desire to participate, in this case we are using demand response to provide the California ISO spinning reserve or ancillary services. In many cases these services are five to 20 minutes long. So the customer who participates is paid an incentive and however in most cases will not even realize the event occurred. But the grid certain will realize the service has occurred.

The technologies. Here today also we'll be talking about things like smaller size radios, communications systems. And the research that we do is helping to check out these type of systems. Their reliability, their performance. And even in the area as we go into communications, research into different commercial buildings and to how well the reception is -- how productive the reception is and how good the reception is in different areas to be sure that when these signals are transmitted they are received and the information is sent back. So we are doing research in those areas to ensure the signals have the full coverage we need to get the services we need.

Also we mentioned cost-cutting value. We also are very concerned about grid security. So the work that we do in communications, the work we do in load management and everything is very important to us. The information flow back and forth.

Grid security, because of these new systems, we now will have the ability to know quicker when something is wrong. Whether it's a maintenance problem, an operational problem. Whether it's a natural catastrophe or weather issue or whether it's a contingency issue from a terrorist. We envision in the future being able to respond faster and quicker with less impact.

So the technologies that will be demonstrated today also have a value in operating the grid security in the future. And we are looking at other areas of the program of how to apply that.

The last thing I will talk about briefly is energy storage. It is part of the discussion for these workshops. And so I just want to bring the fact, again, that if we are not able to cover it all during today's agenda we certainly are interested and we continue to work this area. And I would encourage anybody who has topics to discuss if they haven't been covered today to see me or see my office.

This just gives you a broad perspective of all the technologies we look at. Everything from the residential side to commercial to large grid side. We are evaluating all those for California in the future and how it will support the needs of California.

In the big picture, besides the small customer or residential application, if we use storage for load leveling, for ramping as the load in the morning increases and decreases in the evening, and frequency regulation services. We have done research on all these areas and will continue to do so. We think there is a huge value here but we are still researching how that works.

I think one of the discussions today is about emerging versus enabling technologies. I would say these are emerging technologies because we know what they are doing and we're learning but we're not clear. You will be seeing enabling technologies that have got to a point where they are ready for commercialization and they are much closer to that product perspective. So I think some of the areas we have now we're still assessing how we are going to use these technologies.

One of the areas we spent a lot of efforts in the -- we actually published this in previous solicitations and we have also worked together with DOE to publish public documents that have this. It's comparing the price for different technologies, their application and where they are the most effective.

But what we have been doing now is we are finding -- we are looking at barriers that will prohibit storage and other technologies from going forward. And what we're learning is, for example, when you look at the grid and you want storage to operate as a backup. There's definitions of how a generator will operate and there's definitions of how loads will operate but there's not really definitions of how storage will operate.

So part of the research we're doing is developing those operational envelopes so the ISO can know how to control it. So when they call for it how soon will they get it. When they ask for it to stop how soon will it stop, so they can fit it into their overall system. We are doing quite a bit of work to assess the value of storage and integration of renewables in California. We think there is a value there. We think there is a part there, we just haven't been able to assess the hard numbers and we're working on that.

There's a strong interest in California to rely heavily on renewables and get away from other sources of energy and so that becomes a logical perspective of using renewables 24 hours a day. Storage is one of the ways of being able to do that. Storing it at night when the load is small. In the summer when you have excess energy coming from solar you will be able to store it then.

So the concept is how would that work and how would that cost and what's the option. But if California decides in the future to look at more renewable energy and more use of it, this is one of the options we are researching now.

And I think the last thing we do is we are always trying to focus on key research projects. Our focus is mostly in demonstrating things that work and how they assess them. So you will see also -- and those of you who are participating have interest of showing us some of those. We do demonstration projects with the utilities, with the ISO and with other people in California to assess the value of different projects.

That has been a real quick review. A chance to catch up. I do talk fast. But I will take any questions if I can. But I think the most important thing I want to mention today is this is a piece of the work we are doing, there are other areas. We can't cover everything in one workshop. So I would encourage you to focus on what there is today. If there are questions you have, this is my contact information. Feel free to call me anytime. Questions at all?

PRESIDING MEMBER PFANNENSTIEL: Questions for Mike? Thank you, Mike.

MR. GRAVELY: Okay.

MR. G. TAYLOR: I can always depend on Mike to talk fast and get us back on schedule.

Next up I would like to introduce Mr. Ron Hofmann.

MR. HOFMANN: Good morning, Commissioners and staff. My role today will be to spend some time to try to provide a context for the technology that you will be hearing about all afternoon. So it is important in understanding the technologies that you will see today that you have a context for it.

This afternoon you are going to be hearing from the utilities as they tell you about past, present and future technologies that they have dealt with and will be dealing with in the future. And they will talk about specific load control devices and specific type of communication.

What I will try to do is try to give you a framework this morning for trying to understand where these things fit in. If it's just thrown at you it becomes a bunch of things. And what I will try to do is maybe give you a few little envelopes and slots that you can put this in and hopefully it will be helpful for you.

I will also spend some time reviewing at a very high level the AutoDR concept and standard and PCT reference design. In the afternoon you will be getting two very specific presentations on these topics, one from Clay Collier and one from myself. We will dig deeper into some of the specific issues that may be of interest to you.

And then finally, at the end of my talk today I will just quickly go over some of the things that Mike Gravely hinted at. Which is that the Commission has been funding research that will facilitate much greater flexibility and much lower costs. And when I say that, our mantra is, ten times cheaper and ten times more powerful. So not just simply ten percent better. Really major changes that are getting changes.

So you saw this when Roger showed you in his talk. It's a very busy slide but I think he went through it very well to give you sort of a history of what's been happening. But I bring the slide back up for you to focus on the bottom of the slide.

What I need to do here this morning is to make you appreciate what the value is of the transition from analog to digital technology. It is a major change. Most of you know about it. You use digital technology every day with your PCs. But I think it is important in the context of what you are going to be hearing from the utilities to understand where this change from analog to digital technologies really helps them, and helps them do the things you want them to do in terms of customer service.

In the back of this slide deck, in the backup slides, I put in two definitions for analog signals and digital signals from Wikipedia. You could go to other places to get these definitions. But I am not going to focus on sort of the bits and bytes definition of it. I am trying to give you more of a feel for these differences and why they're important.

The main difference is the element called the microprocessor. Let me explain that in a few minutes. Let's just hold off. But just remember that that is really the critical difference. It's an information processing device.

And what it does is it does something that breaks from the analog tradition in that it facilitates three major things with respects to your current initiatives in AMI and rates and other things that facilitate demand response.

It facilitates customer choice. Technology upgrades, so that you aren't stuck with making decisions where you have stranded assets. And it allows you to get to more understandable standards at the regulatory level. You don't actually have to know some of the details of what goes on in the digital world when you are in the digital world. Because there is a way to understand standards better than there is now.

Just so we are real clear about what analog kinds of controls there are, because I'm sure you have heard about these. You have probably heard about pneumatic controls, fluidic controls, analog-electric controls, electro-mechanical controls. These are all controls in which some sort of an input goes into the control. And without any intermediary it affects the control. It is a true control signal.

In a digital environment it doesn't quite work that way. The input come in and it goes through something called a microprocessor first before it actually becomes a control signal. And it is at that particular step that allows customer choice, it allows technology upgrades. It allows for standards to appear that are quite a bit more understandable than existed in the analog era.

So I am just going to take a couple of minutes here. And I apologize if you all understand this very well. But I just thought we'd sort of get on the same page here. I thought I would use an analog of your personal computer as a way of thinking about digital controls.

It may surprise you to know that the digital platform is identical. Now a digital controller, versus a digital PC, have two different functions that they supply to you. One is focused on what we call data processing and the other one is focused on what we call real-time control.

But from an architectural perspective, they are identical. So in a PC you have a monitor, a keyboard, you have a mouse. Controls don't typically have those things although I have actually seen some controls that do.

But in a control device you have sensors as part of your input/output devices rather than a monitor. You have a display that might be like an LCD display or a keypad but you don't have a keyboard.

But from the point of view of trying to understand what do digital controls do, it isn't that farfetched for you to think about it like you would think about your PC. There's input devices, there's output devices, and information flows through the box and gets processed. And this is a fundamental difference from the analog environment that we were in up until the early '80s.

So the computational platform that we have here can support almost everything that you are familiar with in your PC world. And this is an opportunity for regulators. Because in the PC world and in other digital application worlds like telecom, all sorts of standards and capabilities have already been developed. And this particular industry, which happens to be a little bit behind those industries in terms of using these technologies, don't have to reinvent any wheels.

So in AutoDR, in the signaling capability, we used all of the existing security and standard aspects of the public Internet to be able to do something that is as critical as your personal banking. So if you feel comfortable with your personal banking in terms of the security. If you feel comfortable that the processing that is being done there on an input and output basis, which is what I call data processing.

What you can do at the control level is you can copy that in a very useful way so that you don't have to reinvent any wheels to get the same level of security. But you are now dealing with temperature information, kilowatt hour information. And you are now sending signals to devices like thermostats to maybe set up the set point.

This paradigm of looking at the controls, digital controls of being somewhat like PCs, they really come together when you think about it as processing information. Hope that that's helpful.

One of the differences about controls that is very fundamental is they tend to be real-time devices, whereas your PCs are not. Your PCs actually can do things on their own time schedule. And because they are so fast, you can't tell that they are not real-time. It's a minor difference.

So I mentioned before that these digital control devices facilitated three things. Customer choice. Why? Why would I say that? Why would I make that distinction between digital and analog? Well I make that distinction because as long as you have a digital device, by definition you have a microprocessor which is run by software. It's run by application software and operating system software.

And so from a regulatory point of view, or a specification point of view, one can specify what the microprocessor does with the data that goes in and what it has to do with the data that goes out. And at that point you have a break point in the operation that you never had with analog controls. You have something that allows you through regulations to say, this is what I want this thing to do in terms of privacy, in terms of customer choice, whatever. Because I have this break point, this intermediary, that is acting as my proxy. This is a very important issue about digital controls.

Technology upgrades benefits from the same thing. As long s you have a processor there that can listen to communications it is possible to make your hardware last longer. If the functionality of the control is really in software, which is what I implied in the last slide, you now can change that functionality over time as you get more experience.

If you had a pneumatic control, or you had a fluidic control, and you all of a sudden found out something was wrong, you would physically have to touch the control to fix it. Or potentially replace it with something that actually did the analog that you wanted, the analog control that you wanted.

That is not really the case here. The case here is you have some options to upgrade the technology. I think the good news is all of the utilities on the AMI side have all been thinking about this in very creative ways. And I am looking forward to the day that AMI is deployed with this kind of capability because it means we are not going to get embarrassed like we were back in 2001 with things that go wrong that you can't fix on the fly. And here you are going to be able to fix it on the fly. And the same thing is true of the controls.

And finally, as I implied a couple of slides back. Standards are more easily understood at this point because you are now not having to know the physics. You just need to know the what. You just need to know what it is you want to do, specify it in true English. And that specification in true English can be translated into software into the how.

And so now the regulatory process becomes more deterministic. And you will be hearing a talk after mine in which tools that were developed in Silicon Valley to develop products can now be used potentially to develop regulatory rules. And you will hear a talk from Diane Peptone about that.

So with that it's just sort of contextual background. Let me jump into just a quick, high-level view of some of the things that PIER has been doing, that the Commission has been doing to try to facilitate this.

And let me just say right off the bat, just so there's no confusion, all the work that PIER has been doing has not been to create products. What we have been trying to do is to create paradigms in which products can work interoperably together. So that the customer has the option to choose between vendors and potentially even mix and match products between vendors.

It's a common knowledge among all people in the commercial industrial sector that once a building owner signs up for an energy management system today, because they are all vertically integrated, proprietary systems, that they are locked in for a number of years. They can't go out and go to their competitor unless they want to rip out the entire system. They can't go out and mix and match with most systems that are in the field today because they're proprietary.

But with digital controls regulators can now act for consumers and actually say that what they want is this interoperability and say what features of the interoperability that they want. And these things can be implemented in software standards which can be easily understood. And you shouldn't have to care about the hardware that's underneath. You shouldn't care whether it's one type of communication system or another. The bottom line is, they will interoperate.

So with AutoDR we started off by using the existing public Internet. And with the residential loads, with the PCT, we characterized the three categories that were available to the homeowner as entry points into the home. One being broadband, one being narrowband, which the utilities are using from their meters, and one being one-way broadcast, which is very similar to your AM-FM radio but digital, not analog.

So in these PIER-funded initiatives what we tried to do was to characterize these technologies in an effort to make sure that all the possible innovation that could come out of these three categories of technologies would be available to customers.

Now as you all know, ultimately some of these will fade away because they are either no longer supported or because there is some reason why one particular technology wins over the other. Well that's great. Everybody wins at that. But if you eliminate some of these technologies in the beginning you are not allowing for the possibility of creative new ideas that are potentially much lower cost than others.

This is a very busy slide and Clay will go over this in more detail this afternoon. But what I want to tell you about this slide is that the AutoDR structure is not just limited to commercial/industrial over 200 kW loads. It's a client server architecture that could also talk to radio stations that broadcast price signals. It could talk to any type of device. It could talk to third party people who want to send broadband signals that aren't being sent by the utilities.

Those options are available to the regulators. It's important to understand the client server architecture, which has been used now for about the last 20 or so years in the computer industry, is still a very robust, very flexible and very useful architecture that you could use to make sure the price signals and other information get to consumers. This kind of stuff didn't exist in the '70s and early '80s.

Roger's point that these standards are all about information flow, as shown by this picture. There is nothing special about this picture except that the utility generates the prices from a server. People can either push or pull the information from the server. And through some sort of set of standards it gets to the customer.

And you notice I said, set of standards. It doesn't have to be one standard. You can actually live in an environment where multiple standards exist and coexist together. So you don't have to pick a winner today. You just have to pick the idea that you want standards so people can interoperate.

And typically the standard that we focused on is the information model. Which says, we don't care how you deliver it. We just care that the content of the message meets what the Commissioners want. That if you want prices, and you want prices in a certain way, they can be delivered that way. And we built into it the ability that it can be changed over time.

So this particular type of delivery system, as you refine the system, can actually change the software that delivers it and things behind it will be backward compatible. These kinds of systems do exist.

Roger Levy and I put this picture together last year. The purpose of this picture was not to pick winners and losers but was to make everybody aware that within the home the consumer market has not decided on particular communication standards today. There are lots of communication standards in the home. And on top of it, there aren't very many automated homes. So it's sort of an open market.

But there are a lot of players in the market from the consumer electronic arena. And I think the Commission should think about this in terms of moving forward that the consumer electronic market is very large. The vendors are very large. And they should be brought into the process of understanding what consumers need and want.

That doesn't go -- That doesn't in any way say that the utilities can't send in a standard signal that isn't the signal that the consumer electronic people pick. It can be different. But it means that there has to be a translator or gateway. That's not necessarily a bad thing.

But you have to understand that having multiple protocols is not a terrible -- Having 45 protocols, which exist today, is a terrible thing. Having two or three, four, not a big deal. What do you have to do to make sure that the broadband signals, the broadcast signals, the narrowband signals all interoperate? A common information model. That's the message.

So just as a quick reminder to everybody. One of the outcomes of the research from Lawrence Berkeley Laboratory with AutoDR is a current, proposed load management standard in Title 24 which is called Global Temperature Reset for Large Commercial/Industrial Energy Management Control Systems. And a lot of the companies already have this.

But what we found out is that if those energy management systems have this it makes the process of doing demand response a lot easier. You don't have to run around to every zone in a building and set everything up. You can do one keystroke or one little script in your software and it can make everything change accordingly, according to a customer chosen plan. A customer chosen plan.

In addition to that, as you've heard, AutoDR has now been presented through ASHRAE and through the National Institute of Standards and Technology to people across the United States for comment. It is being reviewed by the IEC, which is in Europe. It has some resistance from proprietary positions of some companies. But in general most companies see this as a leveling of the playing field in which more people can play.

Finally there is the PCT reference design, which is currently on hold in Title 24 and has currently been -- is being considered by the OpenHAN group as a possible standard.

Very quickly let me just tell you where we are and where we're going with technology in general. This will just take a couple of minutes. But what I hope to show you here is that the future is extremely bright. The ability to be able to monitor demand and energy at a cost that is almost zero is coming to us very soon. It will be incorporated in appliances because it will be a no-cost adder. And all we have to worry about is to make sure that that information is available to whatever device in the home is helping you manage your energy. Or any device in the building that's helping you manage your energy.

So today, today's technology pretty much uses 4-bit, 8-bit, 16-bit, 32-bit microprocessors. The 16- and 32-bit microprocessors are capable of any kind of demand response application that I am aware of at the moment.

There are real-time operating systems that allow these microprocessors to handle software tasks that would meet the needs of the regulators. All of that exists. It is fairly reasonably priced. That's not a big deal.

Voltage and current sensors, which are needed to actually measure plug load and other types of energy and demand, are still a little bit too large and costly to be integrated in with the microprocessor into a package that makes them cost-effective. So today you see devices like Blue Line and other devices. It's a small market and so their price is high. But if you look inside what's there you're dealing with basically a non-integrated component design. So that's something that has to change in the future.

Batteries are getting better. You all know about the Tesla and its use of lithium ion batteries. You may only think about that for cars. But as they improve the battery technology there, guess what, it gets better for our laptops and our control devices.

There are two-way narrowband mesh-network transceivers called 802.15.4 that Zigbee is layered on top of, that are very low cost. And they look to be very good IEEE standards. If there is a negative about them, they still need 100 to 200 milliwatts of power, average power to operate. A bit of a problem.

Two-way broadband WiFi point-to-point communications are attaining low power status. There's about four companies in Silicon Valley promoting this. And they are very similar to 802.15.4. Don't take this as a competition in terms of it's good or bad. Think about this as innovation.

So two different, a broadband technology and a narrowband technology, that are both trying to achieve levels of operation that the energy community, the electricity community could use in the future. That's the advantage of this. It needs to be facilitated.

Tomorrow's technology. Microprocessors will include integrated radios, sensors and power supplies. That's the holy grail. So instead of getting individual component microprocessors, memory, et cetera, it will all come on one chip that's so small you probably can't see it.

The Commission has been working on silicon two-way narrowband mesh radios that are now at, today, 100 microwatts. Not 100 milliwatts, 100 microwatts. A big difference.

It looks like that. Mike showed a picture of it. Don't worry what this means, I'm just showing you that it's real. This is one that happens to have existed in 2005 and it actually used 400 microwatts. But there are actual ones that use 100 microwatts today.

In addition to that there's a technology called MEMS, micro-electro-mechanical-systems, which is to etch mechanical devices onto silicon. And then use the electro-mechanical properties of what has been etched on the silicon to be able to do things that we have only be able to do in the macro scale to bring them down to the micro scale. So we are actually building at UC Berkeley today what are called current sensors in silicon. It never happened before.

What does that mean to us? That means that every appliance and every cord and every plug load and every transformer box that you have ever seen today could actually have its own monitor of what energy its using and therefore self-diagnose itself. And even have an included radio and talk to some device in the house that tells you the thing is functioning properly or not in terms of its energy use.

There are MEMS energy scavengers, which I won't go into in any great detail at this point. But there are technologies that allow you to print batteries right onto the PC board, print a circuit board, with ink-jet printers. With ink-jet-like printers. And you can print batteries and capacitors.

These are all sort of Buck Rogers things that are just around the corner. But the bottom line is, is this means that power supplies for sensors, which are so important to energy efficiency in the future, will be able to last 25 to 50 years, which they don't today.

I don't know if you can see this or not but this is what, on the micro-scale, little cantilevers look like. That eventually are interpreted either as sensor information or as energy scavenging information.

So here is my summary. Technology is available to day and it is getting better and less expensive. And in the future you are going to be able to ask for things like totally dis-aggregated energy loads, which you can't get today. When you get the AMI system today you are getting a facility load. But it is going to be possible in the future for just a few dollars, literally a few dollars' bill of materials cost, to be able to have a microprocessor, a radio, its power supply, sensors, energy storage, et cetera, all on some silicon that's going to cost about a couple bucks.

Regulators are going to be able to leverage that in the future. What you need to do now is to embrace the digital design. Understand it in such a way that when the future comes and these things are cheaper, faster, simpler, et cetera, not much as to get changed. Only your requirements have to be increased.

Doing it that way with the digital paradigm allows vendors and utilities to meet these functional requirements because they understand the digital paradigm very well. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thanks Ron. Questions? Maybe not. Thank you.

MR. G. TAYLOR: Next I would like to introduce Diane Pepetone.

MS. PEPETONE: Hello Commissioners and staff and everyone else. My name is Diane Pepetone and I am going to be presenting the results of the PIER project: Requirements Engineering for the Advance Metering Infrastructure and the Home Automation Network, AMI-HAN, Interface.

And I think I would like to spend just a little bit of time on what requirements engineering is because part of the research project was to see if we could use requirements engineering as an enabling technology for policy development.

Requirements engineering, simply put, is a discipline, meaning it is repeatable and there's some rigor, for developing requirements or criteria of a solution in order to either implement the solution or evaluate proposed solutions. And we were using it to evaluate proposed solutions.

It's a process of analysis, modeling, standardizing of information in the solution space. And some examples that you may be familiar with are context diagrams, system interface tables and use cases. And we will be looking at some of them as I go through the slides.

It was first used in the software industry, as Ron mentioned, in Silicon Valley to define software specifications. It has been picked up by most product development projects.

And it is very good for specifying interfaces in complex systems.

So if we look at requirements engineering and utilities we are seeing that they are now using it more and more to define their new and increasingly complex systems.

And examples are Southern California Edison developed use cases as they were trying to specify their AMI system.

And Utility AMI, which is a forum of utilities and vendors, they have a task force called the OpenHAN task force, which was looking specifically at the interface between the AMI and the HAN. And they developed use cases as well.

And as a result we took that as a starting point. This was a number of months ago and I know that they have moved on.

We just took it as, let's look at what they have developed at this point and use it to develop our own regulatory use cases. So we began with initial use cases, looking at the interaction between the customer, their equipment and the utility AMI system.

And then we did different kinds of information modeling. We did Venn set diagrams, which are great because you stick everything in one set. Customer and their equipment. Then you stick the vendors and their equipment and services in another set. And then we put, of course, the utility, their AMI equipment and DR services.

And the point of this is to find out where is that interface where the boundaries come on the different ways that this could be implemented. And is it very clear who owns what and who is responsible for what.

We also used other kinds of modeling to look at different configurations. We used context diagrams. These are very simple. Again, anybody can draw them, including me, which is one reason why I use them. A circle and a square and a line.

And what's interesting is when we did use cases of different configurations and we did context diagrams of different configurations what was interesting to see was where the vendors had their relationship. Did they have a direct relationship with the customer and their equipment or did they have a relationship with the utility in some way.

And we did graphical scenarios which are a little closer to reality. Or we can imagine that yes, that box looks like a house or some kind of a customer premise. And then the utility. And the little yellow thing is our meter and this represents someone reading a meter. And the arrow indicates that in this particular diagram it is going in one direction, which is the way it is for most people right now.

We were working steadily towards something called activity semantic models, which is like the next step before you actually write text in terms of policy guidelines. And basically we defined rights and obligations. And then we used these activity semantic models to actually write the text in terms of rights and obligations.

And a note here. There will be a PIER report on this published soon. If anyone is interested in being notified when it is available, and we may also be able to post this somewhere on the web, I'm not sure, but let me know.

And also there are handout slides at the end that give examples of some of the diagrams that I don't have in my presentation, in particular use cases and semantic activity models.

So why did we focus on the AMI-customer interface? Well as we all know, AMI is essential technology for enabling customer participation in DR. And it introduces a paradigm shift in the relationship between the customer and the utility from a simple arrangement with a customer in their home and the utility on the outside, to up close and personal with the utility talking to enabled devices in the home. For example, programmable communicating thermostats.

And what we were very interested in was how far into the home does this go depending on the different configurations. Because how this interface is conceived and implemented will have a big impact on how many customers participate effectively in demand response.

So that led to considering different types of customers. We looked at the customer who wants the utility to handle all the details. And for this particular customer the solution is exactly what we found in the OpenHAN use cases.

The customer enrolls in a utility

program.

The utility sets up the AMI-HAN interface, which they call a utility HAN.

It's two-way communication.

The customer equipment is automatically registered with the AMI system.

And it might look something like this, where the customer has a PCT or a home area network. This utility AMI gateway is what is described in the OpenHAN use cases as belonging to the utility and it will transfer the two-way signal that was coming in through the meter into the equipment in the customer's home.

There is another group of customers who will have existing equipment and they don't want to lose their investment. And we developed something called the utility program extended option. And the only difference is explicit addition of a communications translation device if it is needed.

Because we did not want to find customers who were early adopters and had equipment using a different communication protocol being stuck and having to either buy something new or not be able to use the equipment they already had. We did want to punish people who are already trying to get on the bandwagon early.

And so, again, the only difference is explicit addition. And it is very likely that that now exists in the OpenHAN use cases. As I said, we have not followed that from the first time when we analyzed it.

But that doesn't cover all of the customers that we could think of. We could think of customers who do not trust technology and would want something familiar.

We could think of customers who do not want the utility intruding in their home and are concerned about privacy issues.

And we could think of customers who are the do-it-yourselfers who want to pick the equipment, they want to set it up, they want to do everything themselves.

And the first option, which we saw on the previous slide, would not encourage these three different categories so we developed something called the Open Market Option, which is a one-way communication system. Meaning that the utility is still on the outside of the customer premise.

It is a broadcast communication and it could be similar to radio, which is very familiar to everyone.

And it allows the customer in the third category who wants to define everything and do it themselves to have complete control over what equipment is used for their automated DR.

And that leads us to the rights and obligations. So combining the customers that we could think of and the assumption that we want to get demand response from as many people as possible we came up with these rights and obligations.

So right number one is the customer has a right to receive price, periodic and real-time signals, and reliability signals without enrolling in a utility program and without registering their equipment with the utility. That doesn't mean all customers have to exert that right but we felt that it should be supported.

If it is then for every right somebody must be obligated to support it or provide it. And in this case the utilities then would be obligated to provide a broadcast price and reliability signal received by the customer equipment that is neither registered with the utility nor in a utility program.

The second right is that the customer has a right to choose if and how they will program their programmable communicating devices to respond to price and reliability signals.

And the obligation here is that vendors need to provide programmable communicating devices that have a means of setting a device to not respond, or a means of overriding the programming.

Right number three, customers have the right to purchase, rent or otherwise select form any vendor any and all devices and services used in energy management or for other purposes in their premises.

And the obligation is that utilities are obligated to provide an AMI communication system that uses an open communication protocol and does not unduly restrict customer choice of customer equipment or services that support performing DR.

Right four is for vendors. They have the right to compete in a open market to sell HAN-related systems, devices and services to all utility customers.

And again the utilities are obligated to not restrict customers enrolled in utility programs to equipment that only uses AMI communication protocol.

Right five: Utilities have the right offer demand response and energy management services to customers which utilize the informational and communication capabilities of their AMI system.

And customers are obligated to maintain their equipment used in utility programs in good working order and to provide any communication translation device if needed.

And finally, customers have the right to participate in utility-sponsored programs, and at the same time, use equipment not involved in the utility program that receives price and reliability signals.

So the obligation is that utilities are obligated to provide price and reliability signals through their AMI two-way signaling system and through a one-way signaling system.

And if we look at the graphical scenarios and the options and what rights they support. The Open Market Option, which is in our diagrams. We gave an example of what that one-way broadcast could be. Which it could be RDS but that's not required. It's not that we are specifying that but it's just as an example. So the Open Market Option supports rights one,two, three and four.

The Utility Program Extended Option, which means that you are enrolled in a program, you are registering your equipment with the utility. It's two-way and there's a translation device if you need it. It supports rights two, three, four and five.

And if you had someone who didn't want to get that translation device but rather wanted to receive one-way signal from that device and they had other equipment that they wanted enrolled in the utility program, that combination supports all of the rights that we defined.

And that is the end of my presentation. Are there any questions? Yes, Commissioner.

PRESIDING MEMBER PFANNENSTIEL: Yes, Commissioner Chong.

CPUC COMMISSIONER CHONG: I'm wondering if you could explain a little further the utility program extended option.

MS. PEPETONE: Yes.

PRESIDING MEMBER PFANNENSTIEL: The addition of the communications translation device. I'm afraid I didn't quite grasp that, I'm sorry.

MS. PEPETONE: That's okay. So that would be the middle diagram. And basically this is for the person who has a device that uses a different communication protocol. So they don't use Zigbee, they use Z-wave or something. And it can respond to a signal.

And so we don't want someone who already did -- You know, as I said, it's probably going to be an early-adoptive kind of person who already has equipment and they are not using what their local utility has decided to use.

And so with a translation device -- Now the assumption is that on both sides you have, as Ron described you have communication protocols that are using an information model that's a standard so that you can translate it.

So that's an assumption that we're making. If someone bought something and no one uses it and it is a proprietary communication then that wouldn't work. This is assuming that it's a standard that can be communicated -- translated, sorry. Does that answer your question?

CPUC COMMISSIONER CHONG: Thank you.

PRESIDING MEMBER PFANNENSTIEL: In your rights and obligations.

MS. PEPETONE: Yes.

PRESIDING MEMBER PFANNENSTIEL: Is there sort of an assumption that utilities have the right to put a programmable communicating thermostat in homes?

MS. PEPETONE: That's a good question. Are we talking about -- Let's see, let's get it down to right five. They have the right to offer DR and energy management services to customers. We never spelled --

PRESIDING MEMBER PFANNENSTIEL: That's an offer, that's not -- That's an offer. So they offer it to the customer and the customer says, thank you, no.

MS. PEPETONE: Exactly.

PRESIDING MEMBER PFANNENSTIEL: So your assumption is that it is not anything that is required of customers.

MS. PEPETONE: Exactly.

PRESIDING MEMBER PFANNENSTIEL: It is just an assumption.

MS. PEPETONE: Exactly.

PRESIDING MEMBER PFANNENSTIEL: Okay, fine. Anything further?

Thank you very much. Great.

I see on the schedule that we are right about the time to take a lunch break and in fact the clock tells me that also. So let's break and come back at one.

(Whereupon, the lunch recess was taken.)

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AFTERNOON SESSION

PRESIDING MEMBER PFANNENSTIEL: I think we are ready to begin the afternoon session. If people will take their seats.

Why don't we start on Section number 7 with Clay Collier.

MR. G. TAYLOR: It will just be about ten seconds here, we have got to do a quick update.

MR. COLLIER: Good afternoon Commissioners, staff, guests. I am here to present the Open Automated Demand Response Communications Standards. I work with Ed Koch, who is both the liaison to the standards effort and the principal author of the standard that we have been working on with Lawrence Berkeley Labs. And I will provide a web address to the standard at the end of this presentation and invite any questions about the liaison status to other organizations to Ed. I'll provide his contact.

So I think this morning's session did an excellent job of the history, definition, benefits of demand response.

I will address that in a very brief fashion and focus on the Open-ADR concept. What it is, where that protocol is implemented. What the implications of that protocol are and what we perceive as the benefits of it.

And then I will you where we stand in the standards efforts in terms of organizations we have reached out to and the reception we have gotten so far.

Now here is a slide showing within of spectrum of where energy optimization can occur, where automated demand response can address the spectrum. Day-ahead, slow, demand response and real-time demand response start moving towards and looking like spinning reserve DR possibilities. Which we obviously find very exciting.

This is the only slide that I am going to present that wasn't presented, in a sense, in the context of demand response this morning.

Roger did a great job of showing the history. I'll point out a couple of elements in this that are interesting because they influenced the decision to move to the standard.

Again, LBNL has been working on this since 2002.

The initial development at DRRC using XML exchange was in '03.

In '05 -- And then use of Internet relays in field trials was in '04.

And then the development of the modern demand response automated server concept occurred in '05. And we collaborated with PG&E's CPP DR program to implement this architecture.

In '06 we expanded the field trial using PG&E's pilot programs. And we used the development of a CLIR box to facilitate getting into facilities that did not have a gateway out in an open Internet mechanism.

We have since that time been able to migrate away from needing to propose specific hardware and find partners that are doing EMCS and the hardware implementations in facilities. So I'll talk about that in a little bit in terms of the standard.

In '07 and '08 we have had commercialization and use of DRAS throughout the state with PG&E, So Cal Edison and San Diego Gas and Electricity (sic). And have been quite pleased with the mechanics of those implementations with those partners.

Last year we began the effort of standardization of the automated demand response communications protocol. And I'll show you where it fits in the overall architecture of the system and what the implications of it are. We see it as an enabler to the rapid expansion of this technology. Okay.

So here is a picture similar to what Ron showed this morning with an abbreviated version of a link to a wireless interface. I'll talk about that a little bit.

If we look at the place of the messaging infrastructure to facilitate a utility or ISO program reaching out directly to facilities, it is the demand response automated server. Right? So you can see the demand response automated server as a messaging gateway that facilitates pricing signals and confirms reliability of messages for an implementation of a program.

If I look at the interface to facilities I can have an open, messaging protocol over the Internet which facilitates a partnership between facilities that have their own EMCS system that can incorporate an XML messaging interface, or facilities that may need an external gateway to be implemented.

We have deployed this, as I mentioned,

throughout the state with partners that are -- Again, this is so far a C&I implementation, 200 kW and above. And partners, we have a variety of partners that we interoperability with using this open protocol to do EMCS, messaging and DR, even at the aggregated load level. So some of our partners for this are aggregators that have their own network of customers that use this open protocol.

The benefits of using an open protocol, and the reason that we wanted to open this up, was so that you can have a rapid expansion of the availability of partners that could get on that bus, so to speak. If you look at the open protocol as an open bus, you go back to the early days of the PC, to go back to Ron's analogies. And you can plug and play different components.

Anybody doing EMCS in a facility that wants to participate in a DR program can use an open gateway to facilitate that. The DRAS itself as a messaging infrastructure facilitates the utilities' implementation of the program with an easy integration. You don't, you don't have to struggle through one-on-one, proprietary implementations and integration.

One of the things that was mentioned this morning in Roger's presentation was that if you look at this being deployed across the spectrum of all proprietary protocols, equipment and implementations you risk having stranded assets. If the utility changes their program some of the assets that were a hard pipeline cannot be modified.

So we believe that it is to the benefit of the expansion of this technology to have an open protocol. And that is why Akuacom has worked closely with Lawrence Berkeley Labs to publish this messaging protocol and make it usable to anyone operating AutoDR.

Let me just go through a few of the standardization benefits. I mentioned vendor lock-in. You know, if you have a specific, proprietary technology there's a danger that a transition in a program costs you whatever equipment, whatever TATI money is spent, in that implementation.

Given an open interface it offers the opportunity for innovation. You know people, and I think you'll see some demonstrations later today, of innovation towards the household side and lower Kw side of technology that could benefit from an open protocol.

And ultimately that lowers technology costs because you have benefits of scale that standardization provides.

It allows DR technology specifications to be interoperable. You can have a variety of programs implemented, as we have, with multiple utilities, that can interoperate with the facilities that are hooked up.

AutoDR can be used for price or reliability.

And with an open standard that has gone through the process of achieving standardization you get security. You confirm security and reliability.

Impact of financial planning for a utility. This is a cornerstone of technology development that enables a series of programs, to a series of interface devices, that we can't yet imagine. So we see, by having the open interface standard, that it can facilitate a spectrum of implementations, we facilitate rapid expansion.

Now this is a long laundry list of the participants over the last several years that have worked on standardizations of various elements of demand response and EMCS systems, both from a facility side and household side AMI.

And then there are some industry initiatives we'll talk about.

We have embraced, whenever possible, these efforts and extended outreach and participated with the NIST to establish an open format to promote the standard.

We so far, as Ron mentioned this morning, see no conflict. We are getting support to participate in the process.

And the standards process has a little bit of uncertainty in terms of time frame. If you take it to IEEE, for instance, you know, what is the pipeline to create a committee, get buy-in of the committee and proceed.

So far over a one year effort the published standard has received good acceptance. We have had the key California utilities participate with comments, modifications and leverage the plan.

So here is where the status, here is where it stands right now. We have recruited participation from the utilities and ISOs and have had hands-on, written comments and interactive meetings.

There are a variety of national standards bodies including NIST, Open AMI and TC-8 that have agreed to -- NIST participated in the Connectivity Week meetings three weeks ago and helped publish a DVD of the standard that we are releasing.

Facility control vendors and organizations, both commercial partners that are doing facility implementations, participated in the demonstrations at Connectivity Week and have shared their stories of how to implement and interface to the standard.

And then end-user organizations, including aggregators and the Retail Energy Alliance, are reviewing the standard. And there are some implications there when you look at three billion square feet of retail space that could be opened up to demand response.

I included a web address at the bottom of the page here. This is where you can actually download the standard. Take a look at it. It's the LBL website for open ADR. And that will give you a view of exactly what the content of the standard is. Any questions?

ASSOCIATE MEMBER ROSENFELD: Clay, you should probably read the invisible yellow on the website.

MR. COLLIER: Oh, thank you.

ASSOCIATE MEMBER ROSENFELD: I didn't even know it was there until you pointed out it's supposed to be there.

MR. COLLIER: Thank you. The web address is drrc.lbl.gov/openadr. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Any other questions? Thanks.

MR. COLLIER: Thanks.

MR. G. TAYLOR: Next up we have Ron Hofmann again to discuss residential enabling technologies.

MR. HOFMANN: Good afternoon, Commissioners and staff. The word PCT often gets different definitions so I thought I would put up a definition of what a programmable communicating thermostat is. And I will show you some schematic pictures as we go forward and hopefully it will become very clear as to what it is and isn't. I like to say that it's a standard programmable thermostat with a wrapper around it. And the wrapper is a set of communications interfaces of different types.

Some of the communications that were planned on have to do with just interconnectivity to the HVAC system. That's a form of communications. But the most important ones are the ones that allow communications to extend beyond the PCT and out of the home. In and out of the home. So a PCT is a programmable thermostat with communications interfaces added.

PCTs have existed for a long time as Roger out this morning. They are proprietary PCTs, they are good technology. So don't interpret what I am saying as anything negative. They are high-cost because the markets are relatively small. And they are proprietary, which means that they have limited markets. There is no large market in which they all can participate.

These markets have primarily been utility defined and so some of the products, some of the PCT products that are in the market today are quite different because of their evolution from particular utilities across the United States.

So the purpose of the PIER-sponsored PCT referenced design was to dramatically lower the cost by creating standard interfaces and a common information model independent of protocol. So we were not trying to define how you would communicate to the PCT in terms of what the physical layer is. But we were trying to get, as I mentioned this morning, to come up with a common information model that allowed proprietary technology to play in a bigger market.

I guess I should say one more thing. Everything you are about to see in here applies to more than just thermostats. When you see the schematic I think you'll begin to understand that any communicating device in the home could actually follow this same idea of basic capability surrounded by communication interfaces.

So let me just take a few minutes, a couple of slides to go over some PIER PCT history. In 2005 PIER held a number of workshops that were facilitated by Erich Gunther having to do with defining what is a reference design and what is system integration.

Because the basic idea here was different from what the Commission had dealt with in years past when they dealt with energy efficiency standards for refrigerators and other devices. This is a device that is more than just a widget. It is a widget with communications capabilities. It is part of a system, by definition.

In 2006 PIER proposed and demonstrated a proof of concept PCT to show that the idea of reference design and system integration do apply to thermostats.

In 2007 as a result of a study that was completed in 2006 by the University of California, PIER facilitated an open industry forum to establish a reference design for a PCT based on this proof of concept PCT that could be proposed for the Title 24 standards in 2008.

That particular reference design is on the web. And anybody that would be interested in seeing it, it's on the LBNL site. But if you just e-mail me I will give you a direct link.

In January 2008 the Title 24 PCT rules were challenged. That's the regulatory rules were challenged. And the PCT reference design was removed from consideration. So here is a very important point. There's really two parts to the PCT. They are the parts where the rules were set for regulatory purposes, for Title 24. Which takes advantage of the reference design. But the reference design is a separate document which is independent of the particular rules.

A particular rule in the Title 24 procedure was challenged but it didn't invalidate the design. The technology still stands quite independent and can respond to any set of regulatory rules. Remember my conversation this morning in that all of this is instantiated in software, not in hardware.

In April 2008 OpenHAN agreed to, which is an industry group led by the utilities, agreed to consider the PCT reference design. And that i underway under the facilitation of Erich Gunther.

And this afternoon after a few more talks you will get a chance to see a couple of prototypes, tested PCT prototypes. And we will actually do a test using one of the communication links as an example.

So if you remember from this morning I made a distinction between what the regulators want versus how industry and the utilities implement it. And so when we started with the PCT there were a clear set of objectives that were presented at a number of workshops and became refined to these four bullet points?

So the idea of the PCT standard that we were looking at was a set of system integration interfaces that could be applied for anybody who lived in California, and hopefully the whole United States.

A common information model for everybody in California. what this means is that if you live in Southern California Edison's territory you don't have to buy a special PCT with their information model. And I don't think they want that either.

This allows for the hardware to be a high-volume entity. And what might distinguish various PCTs is the software and how it's used. But from a stranded hardware point of view, this sort of eliminates that and creates a large market for more vendors to participate in the thermostat market.

Number three. It needs to be able to work with any minimum AMI system. If you have the very sophisticated AMI systems the chances are the AMI system will be smart enough to work with almost any vendor's products, I think.

But if you say it the other way. If you say that the PCT has to be something that works with the minimum functional AMI system. And a minimum, functional AMI system might be something where there's a communication system on the utility side of the meter but there isn't one into the home. There is an interval meter, there is a communication system back at the utility, there is back off the software.

But a particular utility in the United States or a public utility in California might not choose to implement the link into the home. So we said, we had to have an option for that. If everybody chooses to have a link into the home, that's fine. This is for working in the minimum AMI case.

And finally, it has to be compatible with all legacy HVAC systems. All air conditioning systems and all heating systems.

Finally with this quote, what, the industry will work out the how.

We had some -- We had some cost and price targets. If you remember Roger's slide early this morning, he showed that in the 2005-2006 time frame the company E3 did an analysis for the Commission to see what was cost-effective from society's point of view. And they determined that the PCT that cost $150 to the utility, that would be a wholesale price, was cost-effective.

Based on some studies we did we realized that that was a lot larger than it had to be if you defined these interfaces in a open way. And so we came up with some criteria based on a study that we did at the University of California that all of the additional bill of materials cost could be less than $10. And a retail price, that's typically usually twice the cost of a wholesale price. A retail price could be less than $100. So that was a goal that we had.

And remember from Roger's discussion this morning, the proprietary PCTs in the marketplace, because they had a limited market, was more in the range of $200 to $400 wholesale. Price to the utilities.

So how did we go about doing this? There is no one way to do this. But we came up with something that everybody agreed with. And what we decided to do was to create conceptually four interfaces. A built-in communications interface, a man-machine interface, a human-machine interface. An HVAC interface, an expansion interface. All of which we wanted to standardize.

As you will see later on in my slides, the HVAC interface fell by the wayside because even though we had a way to plug thermostats into the wall in a uniform way, NEMA sent us a letter that said, it's too early to do this, let's wait until 2011. So we dropped that one. So we were left with three interfaces to explore.

This is what that looks like conceptually. So conceptually we have a thermostat, which is the yellow. Anybody's thermostat, it doesn't matter. What is inside the yellow is proprietary. It's the special sauce that each of the thermostat manufacturers comes to market with that differentiates them from everybody else. It includes the packaging and how they go to market.

And what we did was we created standards for four types of interfaces that would be attached to their standard offering. And their offerings could be from minimal thermostats to something that played the Star Spangled Banner every morning. It wouldn't matter. What people would buy is what people would buy. In the yellow part of this picture, whatever the market would bear would be okay. But where the blue is, everything would be standard so that there could be interoperability.

We did a concept prototype in which we actually tested this and we brought it to the Commission. I believe it was April of 2006. And we demonstrated it to Southern California Edison. And it clearly worked.

There is a complete 192 page report on all of the work done by the University of California in terms of modeling, in terms of prices, in terms of costs. All of this stuff was published on the web as we went through so that all the manufacturers could take a look at what we were doing and show us the error in our ways.

The sum total of this 192 page report which is posted on the web and I am happy to direct you to if you send me an e-mail, pretty well lays out a great deal of research that shows that not only is this possible, but in fact all of these numbers have been vetted with industry.

So just to give you a little summary quickly. This is what we got several years ago in terms of a bill of materials that said, an equivalent minimum, important word. Equivalent minimum programmable thermostat. Bill of materials is about $13.

And that just by quickly going out and checking with vendors, how could we create these four interfaces at minimum cost to meet the objectives of an interoperable PCT that could do price response, it could do a number of different things. In fact it could be reprogrammable so it could, in fact, do different things later in time. The total bill of materials came to about $20. It was a little bit less than $18.

Actually remember I said, NEMA said, well we don't want to do the HVAC interface right now. So actually the bill of materials is actually $2 less than this going forward because we dropped that for now.

How did we know this was true? How did we know that this was okay? Well we posted a complete spreadsheet with the bill of materials on the web. And we know from manufacturers who called us and said, yeah, can't argue with that, that looks okay.

We also did one other thing. We grabbed

a picture from the Sunday paper from Home Depot and we looked at their ads. And you can look at the arithmetic that I did there, you can do it any way you want. But if you take the $12.70 base price for a programmable thermostat, whether you use a multiplier of three or four, which are typical multipliers through all the channels to retail, you get a number that's very close to the numbers that they are charging for these various thermostats that are in this ad. So we knew we were in the ballpark. We had a way of vetting this. In addition to having talked to a lot of different manufacturers.

So the PCT reference design is posted on the web. It has costs for all the elements. It has a proposed scheme for security and registration, which could be adopted by the utilities and all users, it's all there. The utilities and the vendors participated in this process. The proposed RDS one-way implementation of communications is in this, in this particular reference design that's on the web. And the expansion port, which is critical to this overall design, is also there.

And I just want to take a moment to tell you about these two items. The RDS is only one of the communications channels into the PCT. The PCT also supports narrowband and broadband, either through the expansion port or through eventually being on-board in the machine.

Remember the example I gave earlier this morning about external modems? Well when the PC came out all communications were external. They came in through the RS-232 port. This is the same idea here. Until we understand 100 percent what that communication channel is for the thermostats, the thermostats can at least at this time have expansion ports.

So that if a particular communication channel failed, if something went wrong and we all of a sudden found out that one particular type of communication wouldn't work, you could exchange whatever you stuck into the expansion port. You could plug in a different modem, so to speak.

That could allow you not to have to throw away the thermostat. So it was an idea that we proposed. It may never be used. Because maybe at this point the utilities have come up with a strong enough standard with Zigbee that maybe that can become the internal communication standard.

To be determined.

But the design is what I am trying to promote to you. The idea of the design is to make sure consumers don't have stranded assets and that they have minimum cost.

There will be some vendors here this afternoon who will talk a little bit about their products in the public comment period. And I think you are going to be quite surprised at what already exists out there that is starting to follow this design. And I think they and the utilities are all looking forward to something like Title 24 specifying this reference design as being acceptable. What has to be wrapped around it is acceptable regulations.

Recently there was a bill passed, SB 1491. And as far as I can tell the PCT reference design is compatible with SB 1491.

Thank you. Any other questions?

PRESIDING MEMBER PFANNENSTIEL: Questions?

ADVISOR TUTT: Yes, Ron, I just had one question. You mentioned that the possible Zigbee structure. I presume that even if that were -- ended up being part of the eventual reference design that you would still include it in the expansion port reference design in the PCT?

MR. HOFMANN: Yes. Even today the PCs have expansion ports. They are called USB ports today, where they were called RS-232. There is still always value in having this port where things are externally connected. Either permanently, or for the time being while you figure out whether this is the right way to go. So the answer is yes.

I know there is one manufacturer that's been thinking about multiple expansion ports. If you go back to the bill of materials you'll see expansion ports are very cheap. They are basically the same expansion ports you have in your camera, they're SDIO ports.

So again what we have tried to do is not invent anything new. We have gone out to pick technologies that already exist. So the SDIO port is a standard technology.

The RDS one-way technology is going to be in probably all cars in a few years. RDS is what enables you to see what song is playing on your LCD screen in your car. And there's a number of cars from General Motors and Chrysler that come out automatically with these things. It's a very low cost technology that I believe is a good transitional approach to finalizing within five or so years, ten years, the two way technology that's going to be built into all thermostats.

If it could be chosen today and everybody is comfortable with it and it's proven, field proven, maybe we don't have to go through the step. But my experience in this area is that, I doubt it. Even some of the best wireless technologies that have been deployed over the last 30 years of the career that I had in the wireless area have all hiccupped. All. Even the best. The ones we look at today and say, gee, they are just solid as a rock. You go back in their history, you know, they had growth pains.

So I am trying to put belts and suspenders on this and make sure that we don't get embarrassed by specifying reference designs that don't have some legs. This has legs.

PRESIDING MEMBER PFANNENSTIEL: Other questions? Yes, Commissioner Chong.

CPUC COMMISSIONER CHONG: Thank you. I want to commend you on this initiative because I think this is very important for the future of the electric industry. I particularly am very pleased to see the fact that you are achieving a statewide standard, that is very important.

And secondly, it seems to me that the fact that these all work together is a big benefit to the retail market because it will drive prices down and make it more affordable for the consumers.

The question I have is, what is the schedule for the OpenHAN review of the PCT reference design? What is your guess?

MR. HOFMANN: I think they are in process. Erich Gunther couldn't be here today because of a Smart Grid activity in Washington DC. But the last time I talked to him about a week ago he said that it had already been brought up. It was in play in the committee. I would imagine it's weeks to a month or two that they should decide on whether it can be done. If you would like I would be happy to contact him again next Monday and just find out what the status is.

CPUC COMMISSIONER CHONG: Thank you. The other question I had was you talked about NEMA asking you to pull out the HVAC interface. And I wanted to ask who NEMA was.

MR. HOFMANN: Does somebody want to help me here? I've been calling it NEMA so long I don't remember what the acronym stands for. Manufacturers Association.

PRESIDING MEMBER PFANNENSTIEL: The National Electrical Manufacturers Association.

MR. HOFMANN: National Electronic (sic) Manufacturers Association, sorry.

CPUC COMMISSIONER CHONG: So when you say you pulled it out, you --

ASSOCIATE MEMBER ROSENFELD: Delayed it.

CPUC COMMISSIONER CHONG: You delayed it. But there's still a little place in the standard for it, right?

MR. HOFMANN: Absolutely. What was proposed was a particular connector, which is used worldwide and is made essentially in the billions every year, so it's a standard connector. They just said, and I think it was a reasonable statement, that they couldn't respond fast enough through their channels of sales and installation to deal with something like this, they needed more time. I believe there is a letter on file from them about this. It may have been sent to Commissioner Rosenfeld at one point.

ASSOCIATE MEMBER ROSENFELD: My recollection is it only asked for delay.

MR. HOFMANN: It did. In only asked for a delay. By the way, just to make you understand how important that particular interface is. If you have ever tried to change your thermostat in your house and dealt with all the different colored wires, even people who are expert at it, screw it up. So it would be nice to just have a little plug-in thing.

And that means that the wires in your wall would already be hooked up to some sort of receptacle and you would never have to worry about it. It would be easily retrofittable. But then every thermostat would come with this connector. Whatever it is, industry will figure it out. But that standard connector, like an RJ-45 plug or a DB-15 plug or something, would just plug into the wall.

And then if you wanted to change your thermostat you now can do it easily. You have eliminated the cost of somebody coming in and doing it for you. So it was an idea that I think the industry also accepts but they wanted the delay.

CPUC COMMISSIONER CHONG: But it is expected it will go forward, just 2011.

MR. HOFMANN: Well, the PCT itself is in doubt at least at this point for Title 24 so that has to be first resolved. And then the second step is, what to do about that other interface. And I don't know the status of that.

CPUC COMMISSIONER CHONG: Okay, I understand. And I'm wondering if you could tell us just a sentence or two about SB 1491. I am not familiar with that bill.

MR. HOFMANN: I wonder if I could defer to somebody else here.

PRESIDING MEMBER PFANNENSTIEL: That's the bill --

MR. HOFMANN: I'm sorry, it's not passed yet.

PRESIDING MEMBER PFANNENSTIEL: No, a bill, not a law. Correct, absolutely.

CPUC COMMISSIONER CHONG: Thank you.

PRESIDING MEMBER PFANNENSTIEL: Ron, your page of Home Depot advertisements of programmable thermostats. Non-communicating, programmable thermostats, I assume?

MR. HOFMANN: Yes.

PRESIDING MEMBER PFANNENSTIEL: Sort of trigger the question of, is there the expectation that at some near-term date the PCTs are going to be on display at Home Depot?

MR. HOFMANN: I think the answer is yes. But I think I will defer to the public comment section when I believe the company that actually makes thermostats for Home Depot could answer that directly. But I think the answer is yes. That I think that various versions of things that look like the Title 24 PCT are poised to go on the market very soon. How they are enabled, I think you have to ask Tim Simon from Golden Power. And he can explain to you what the plans are for Home Depot. I don't know them personally.

PRESIDING MEMBER PFANNENSTIEL: Okay, thanks.

ASSOCIATE MEMBER ROSENFELD: Ron, Commissioner Chong had one question about an interface, the HVAC interface. I want to try to clarify a little bit your human-machine interface. Because in fact the non-communicating thermostat already has a human-machine interface.

MR. HOFMANN: Yes.

ASSOCIATE MEMBER ROSENFELD: Although

looking particularly at the pictures we just referred to from Home Depot, some of them look pretty small and ordinary to use the program, the extra complications of time of use pricing.

But do I gather that if you are willing to go stand in front of the thermostat and try to program it directly, that you would not use the human-machine interface. You would use the crystal display on the thermostat itself.

MR. HOFMANN: If you look at this slide that I put back up here for the human-machine interface. Notice that the added cost is only 15 cents.

ASSOCIATE MEMBER ROSENFELD: Yes, that's what I'm driving at.

MR. HOFMANN: The implied issue was that we would use whatever the manufacturers have. Some manufacturers have touch screens, some manufacturers have keypads and LCD displays that are hard to read. All of that was expected to stay.

The 15 cents was for two things. A little LED light that told you when you were in a demand responsive period. To let people know so they could just quickly just glance at their thermostat and see that the red light was on.

And also, what I call a Homer Simpson button. It was an override button. So one of the things that was misunderstood by the Legislature when they thought that this particular device might be Big Brother. You always had control in the design with an override button. I think that may have been misunderstood.

The regulations, however, said there was one event under which you would not be able to use the override button. But part of the 15 cents was to give the user complete control in overriding whatever they had programmed. So the 15 cents includes a button plus a light. Everything else is whatever the manufacturer offers in their line of thermostats, whether it's touch screens, key pads.

And remember, now that we have a communication link we now have an energy efficiency enabler in that there can be services that are sold over the web where somebody could plug into the expansion port a WiFi connection and somebody could sell them a service to help them -- a third party to help them manage their energy through that WiFi connection if they have a router.

So the idea is, on the human-machine interface, is that it's a no-cost extension to your PC if you have communications. If you see that connection.

ASSOCIATE MEMBER ROSENFELD: So just to bring this point out. If you are willing to cope with the small screen display on the thermostat, all you need is the red Homer Simpson override button. And you said a second thing.

MR. HOFMANN: A little LED light just to let people know that you're in a critical period.

ASSOCIATE MEMBER ROSENFELD: The LED light which says I am receiving information.

MR. HOFMANN: Yes.

ASSOCIATE MEMBER ROSENFELD: On the other hand, these things are notoriously unprogrammed by many people, like VCRs. So I guess a dream of all of us is that also around your house somewhere is your PC with a comfortable keyboard and a screen and information from your friendly utility about how much electricity you used yesterday and so on.

Where does the PC get its information? The PC, not the PCT. Where does the PC get its information? Does it get it from the meter or from the PCT?

MR. HOFMANN: I think that's yet to be determined. I think what we have done with the PCT is allowed for all of those options. We have allowed that the manufacturers and the utilities can get together and come up with a number of options that are different for different kinds of people.

So some people who are home enthusiasts and can do it themselves might go out and buy a $30 addition to their PCT that allows them to talk to a new WiFi because they already have a router in their house. And therefore they are connected now up to their PC and they could do it themselves.

Other people say, let the utility do it for me. And that's a good option too. And through the utility link they can get the same programmability.

How those things develop I think are to be determined. What the PCT does as a standard is it enables it. So this is an enabling technology that can grow and we're copying the essential, architectural design of what was done with personal computers.

So if you look back at that and you say, this has been unbelievable -- there's been hiccups, well all know that. But if we have enabling technology that allows the technologists to offer people things through these many ports and options. I think we will eventually arrive at a solution that we all like. That's the hope of the PCT.

And again, the PCT is just a thermostat. The same interfaces can work for any other device. And my colleague, Dave Hungerford here, has often talked about PCDs, programmable communicating devices. That's a possibility when you look at it from the system integration point of view.

ASSOCIATE MEMBER ROSENFELD: Thank you.

PRESIDING MEMBER PFANNENSTIEL: I just need to clarify the point that you made about the override button. I don't think there really was a confusion about whether or not these devices had an override button or whether you could use them or whether they work.

I think it was more of the sense that from the Legislature, but I think even more those customers who wrote in, it was more a question of just not wanting to be bothered with having to deal with even an override button. But I don't think people misunderstood the fact that there was an override button. I think people just didn't like the concept of the device to begin with. A different, a different issue.

Further questions? Thanks, Ron.

MR. HOFMANN: Thank you.

MR. G. TAYLOR: We're just going to do a quick switch, one little minor update on a slide. So excuse me for that.

Thanks for your patience. Next up is Ray Bell, the first of three speakers to talk to us about different types of communications.

MR. BELL: Good afternoon. Thank you for asking me up to talk about broadband today. I'll make it brief. I was told I had 15 minutes but I'll go through and at your leisure you can tell me if you would like to extend that.

A little bit about Grid Net, briefly. Grid Net is a company that builds Smart Grid network management software for next generation utility Smart Grids. We also build WiMAX products for the Smart Grid, which is probably why I was asked to talk about broadband today.

I'm supposed to focus just on broadband technology and give you a brief kind of view over that. And what this slide is meant to point out is that from a broadband perspective there's really two main domains in the network that are probably relevant to the discussions here.

And that's the metropolitan access network, that's the network in the city or the county or the service territory. And the home area network, which a lot of people have been speaking about. There's other broadband in the network but it has to do with the core infrastructure, which is why I have it grayed out in the slide.

If you look at, today, what's out and available in the market, you have cable infrastructure, a hybrid fiber coax cable infrastructure which provides broadband to the home. You have the telephony system, the unshielded, twisted pair telephone system, which provides broadband to the home.

And you have a variety of wireless technologies on the market, a third generation wireless moving the fourth generation, that also provide a wireless broadband. The difference there is that not only is that fixed but it's also mobile, where the other two are fixed.

If you look at the current technology, where we're at at this point in time, we have third generation cellular technology. Its origination was in voice and so its architecture was around voice communications. Over the last four to five, ten years -- probably five or ten years -- it has been migrating to be able to support data. And so today the technologies that you have on your PDAs or phones is generally one of these two technologies, either GSM or CDMA.

Many of you may have heard of WiMAX. WiMAX is a fourth generation technology that was developed in the IEEE. It is not well-deployed in the United States. If you have seen the press it's on a process of rolling out throughout the United States but it's quite well-deployed in other countries. And it's gaining fairly strong momentum.

There is a competitive technology to WiMAX which is emerging out of the third generation wireless group called LTE or Long Term Evolution. Currently the update on that is the standard ratification is expected at the end of this year and you will start to see product in '09. And vendors, I believe such as Verizon, have indicated a direction towards that technology.

Having said that, there is a lot of discussion going on in the ITU, in the IEEE and the 3GPP around, do we really want two competing standards or should these line up on a path forward as we move forward into 2010, 2012. That is to be determined.

The other major metropolitan access service network or MAN network technology that we talked about was cable. Which many of you know today is sponsored out of cable labs in the ITU. DSL, over your telephone lines, and Ethernet, which has been here for many, many years.

So if you look at just those metro technologies. What I tried to show, just very briefly, is a picture which will show on the left the cable infrastructure where you have a head-end, often with satellite down-link for entertainment provisioning.

A fiber optic network, a hybrid fiber coax network that goes on the telecom section, generally in the utility infrastructure. And it is very similar to the telephony system, which also shares that same sector on the utility infrastructure but for voice.

Cellular wireless, and in particular WiMAX, is a wireless broadband technology that is different than the third generation technology in that it is actually wireless broadband built for voice, video, data. It uses traditional router and switch technology that you find in the Internet for the backbone network. And there are over 500 vendors today who have commercial products on the market with interoperability profiles. And these are companies like Motorola, Cisco, Nor-Tel, Alcatel, Intel, General Electric with their new product are in that space.

From a home perspective many of us are quite aware of WiFi. It came out a few years ago. It has become the predominant, local area network within the home. There is a variety of WiMAX releases. Recently MESH, low-power-based MESH WiMAX has entered into the market as a competitor to the other low-power MESH technologies. So that's to be noted. That there are technologies today that are looking to be in this space. As Ron said, to possibly be a USB port addition to the PCT. So that technology is available today.

Ethernet is not well established in the home because when most homes were built people didn't run Cat5 cable, which is what you want to run your Ethernet on in the wiring premise.

Which led the industry to develop a alternative technology, which is modeled on Ethernet. It uses similar framing network technology. And that's done by the Home Plug Powerline Alliance.

And most recently that's been rolled into the IEEE for a standardization process. There was a competing standard with Panasonic. And it was moved in, these two were moved in and are being merged in the IEEE. Given Home Plug's design around similarities with Ethernet it will, I believe, fold into the Ethernet or the 802 family quite well. So this is technology to be aware of.

Without talking about companies, we have seen this technology now successfully go from a meter, over the wiring, over the HVAC transformers to the 24-volt PCT. So this technology is now viable in terms of -- And that's a two-megabyte bi-directional signal.

From a home perspective I think the real issue, and I have been involved in discussions at the Commission here and in the industry and watching the Title 24 work. The kind of take-away that I have is that consumers want choice. All right. And the retail market needs to embrace that choice.

And if you look at -- The purpose of this slide is really to show you that when consumers think of their home they don't think of just their thermostat or their smart appliance. They think about their television, their entertainment system, their music systems. Their computer and their Internet. So really the home network needs to consider both aspects of this environment.

Because if you have a control system that doesn't interface with the consumer electronic products you will end up having multiple interfaces, multiple networks and the like. So nothing other than to point out that you have both wired and wireless broadband technology in the home today.

The reason I put the meter above the home area network is that I want to talk a little bit about, from a broadband perspective, an option from a meters perspective. From cable, the problem with cable and a meter is the installation. Most often the -- While a cable termination may be on the side of the wall by the junction box it is a very expensive installation process to be able to use that technology.

People have discussed putting Ethernet interfaces on meters to simplify that process but that is a fact.

The same holds true for the existing telephone network for DSL. Again, you could put a jack in the meter but that's what was discussed there.

We recently introduced a WiMAX smart meter to the market. It's commercially available. And not only does it serve as a smart meter but it also serves as a broadband router to the home. And so it opens up a whole lot of new possibilities in demand response and utility information to the customer.

We believe in the next year or so you will see, with the technology that we know is coming and in the market with the television manufacturers, you will see the meter be able to send hi-def, streaming audio/video signals to the television as just part of the retail market.

And just to close on these topics. I thought this slide would be a useful view. We talk a lot bout standards and numbers and alphabets. But what I tried to do is put this into a visual that said, if you look at the IEEE standards that we talk about, whether it's the 802.15 or 11 or 16, these standards were designed for particular uses.

And you can see from the 15, the personal area network, the original design was to replace the serial cable. Bluetooth, Zigbee, are implementations on that platform. You can, and people have, worked to build MESH network infrastructures on this technology. But that's not what the IEEE originally designed it to do.

WiFi was, again, designed primarily for broadband in the home. Or in your office location wirelessly, or mobile broadband.

There's been a lot of people that have tried to build WiFi metro infrastructures. Most of them have collapsed. Which would lead you to believe that you really don't want to have tens of thousands of things on poles trying to build a network infrastructure.

WiMAX. This slide is probably a little dated because WiMax has now been merged into the IMT, which is a telephony, a long-term, third generation telephony movement. And you can see WiMAX actually provides not only metro coverage but coverage all the way into the home.

So I think that's what I have. Just to talk about broadband and answer any questions that you may have.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Are there questions? No?

CPUC COMMISSIONER CHONG: I do have one.

PRESIDING MEMBER PFANNENSTIEL: Yes, there is one.

CPUC COMMISSIONER CHONG: So I'm trying to understand, what will WiMAX bring us that the PAN and the WiFi didn't, Ray?

MR. BELL: WiMAX is a metropolitan access network technology. Commissioner Chong, it's not what will it bring us. If you look at the LAN, that technology was designed to go 150 meters. It wasn't designed to go kilometers.

From many people's perspective -- And I'll talk about Intel, Intel is a major investor in our company. WiFi and WiMAX are not competing technologies, they're interoperable technologies.

In fact, what you'll see in the middle of '09 are laptops that will ship with both WiMAX and WiFi integrated so that you can have a seamless experience from outside your premise, your office or your home. And as you move in you'll reconnect to your home area network.

So it is not competitive. It's just the use of the right technology in the right place in the network I think is probably the right answer.

What it does bring you over third generation technology is that it was actually designed for voice, video and data. And so its infrastructure costs are so much lower than traditional 3G technology that it becomes a viable solution for AMI, as an example, given the monthly service charge. Which is probably far less than the utility would pay to read a meter manually today.

PRESIDING MEMBER PFANNENSTIEL: Tim.

ADVISOR TUTT: Ray, I just have one question. I've heard this term many times over the past months and I guess I'll display my ignorance in public. What does MESH mean in this?

MR. BELL: What does MESH mean? MESH is

a type of technology approach where you -- and it's usually called ad hoc MESH. Most people would refer to it that way in these solutions that are on the market. Where a device will go and discover locally other devices that it could communicate with. And in turn that device would establish communications with other neighbors. And you build up this network of MESH devices, devices all interconnecting. And you can then move a packet across that MESH.

The value proposition is that itself it's ad hoc and it will come up and it could go away and it will reroute. And I think it's very viable technology for its designed purpose.

PRESIDING MEMBER PFANNENSTIEL: Thank you.

MR. G. TAYLOR: I would like to welcome the second of our three presenters on communication protocols, Roland Acra.

MR. ACRA: Good afternoon, everyone. So I am here to cover the alternative method to reaching, particularly devices within the premise of the subscriber for a usage pattern that is expected to be -- it's been called Bursty in the title but in general it's expected to be telemetry style interactions, meaning rather infrequent corrections. And at that, each piece of communication tends to be somewhat modest in the amount of communication that needs to be moved.

I have taken in my presentation a few views of the AMI network, mostly for perspective. And then how this ties up with the home area network, as it's been called, in the demand response side of interactions.

And truth be told, I'll make a little bit of a pitch for the open standards IP. The Internet protocol-based approaches to these things, which is one that we believe has quite a bit of merit. But I will do my best in portraying everything that is out there be it wired or wireless, Internet based on not.

The picture that I will probably be referring to quite a bit during the presentation is the following. And what I have represented here is on the top left part of the picture what would be the utility operating center. This is where presumably the intelligence of triggering demand response programs or pricing signals or what have you is driven by some application software on a server back-end.

Then there is a variety of ways of getting to the destination, the intended destination for these messages. If we presume that in this context are generally two classes of destinations. One is the meter itself. You are trying to get new information to the meter to put it in a new pricing regime or to reset it or to read it. That's one class of devices. And I represent those at the bottom edge of the neighborhood area network/AMI cloud. That's in the middle right of the picture.

But then there are interactions that are really intended to be conveyed all the way to a device that is within the subscriber's premise. And these are the things that could have an impact on the actual load on the grid. So if you are really trying to shed load you might want to change the setting on a thermostat or turn off a device all together in order to relieve the grid.

Homes or premises in general are going to have multiple ways of getting into them. I'll be talking about the AMI network in a transit role towards these end devices inside the premise. Knowing, however, that there will be often in the subscriber premises, alternative ways of getting inside of the home using something like the user's broadband Internet connection, for instance, or a phone line for that matter, if you want to get back to the most common denominator for a way to get into the premises.

I have picked different arrows, red and green, only to illustrate the point that it is unclear that we will always have the luxury of having a single technology, a single communication technology to cover all cases. And that's part of what I'll be talking about, is doing a bit of compare and contrast between what technologies are available for which class of devices.

Alphabet soup. I'll be covering some of these terms. Some of them refer to link communication technologies, some of them refer to protocols. I'll do my best. I have first a big table that I am going to walk through.

I've put four, although there are dozens of others. And these are -- In my mind those are perhaps the most well-known out there. And on purpose I have picked two columns, which are the first from the left, that are wireless, low-power wireless based using the 802.15.4 low-power protocol, which Ray referred to earlier as the

PAN, the personal area network technology.

And I have picked a couple that were wired, and particularly wired in a powerline communication sense. Again somewhat arbitrary, Home Plug and Echelon. I am not going to go through every cell in that table, obviously, other than to say that there's quite a few things that one has to look at.

And some of them are not a choice. Some of them are such that in one residence there is good quality wiring for power line communication transport that can be reliable, in other cases you don't have that luxury. Either because the distances are too long or sometimes the device itself, like a thermostat, simply doesn't sit on the 110 volt or 220 volt AC line, it sits on a 24 volt line that comes from the heater, from the furnace.

So that is why I will be dwelling quite a bit in the presentation on the notion of layering and the ability to have abstractions that can be implemented end to end without requiring to be tied to any one physical layer of technology. That's what we believe is the good approach for investment protection, especially for long-cycle investments.

You asked about MESH and what that meant. The MESH does apply in these contexts of home area networks and premise area networks. Largely because often the single hop MESH is best contrasted with single hop. Single hop is where you have to have every device that is being given connectivity have direct line of sight communication to an access point or a hub of some sort. This is how we use WiFi typically. If I don't have good enough reach to the access point, that's it, my laptop or my PDA is not going to be able to communicate.

Contrast this within MESH. Nodes in the network that are meant to be themselves communication end-points, like a laptop, can also help relay the data to other friendly nodes nearby. And that's the notion of MESH. Each node is a router in addition to being an end point of communication. Okay.

And that's a very good technique to extend the reach of a particular radio technology. It is also used in powerline communication, by the way. Sometimes there's a particular number of meters that a good powerline can traverse. And if you have longer ranges than you have to relay and reboost that message. So very much that concept.

I do want to perhaps here dwell on the fact that about halfway down I have network and transport. I want to call people's attention to the fact that in that category of low-power radio communication people have sometimes used the word Zigbee interchangeably for designating the standard IEEE 802.15.4 radio. Which is a low-power that lends itself to being meshed radio, with also a suite of things above that radio, a network and transport layer, and in addition even standard ways of describing a device. How does a thermostat present itself to a remote device to interact with it? How does a meter present itself? How does a load control module present itself?

For purposes of this presentation I will use 802.15.4 to designate the radio because now there are alternative stack technologies, the most prominent of which is TCPIP. That is available in the same efficiencies and low power and low footprint and low cost as Zigbee is. And so we need to start distinguishing whether we refer to the basic radio, which is common to both, versus different networking technologies that we layer on top.

Any questions on the slides? I wasn't able to do an exhaustive job of covering it. Keep going.

Here are some considerations. And I've got two pages of those, of what to think about in making these determinations of what's the proper communication technology.

Number one, what kind of a medium is the dwelling? As far as, again, good quality wiring, yes or no. Good radio frequency propagation, yes or no. To all of the home, to part of the home. To the part of the home that I care about in particular where the thermostat might be or where the meter might be.

And there's a variety of choices there. There's no one size fits all I guess is the short answer to that bullet but it needs to be looked at on a case by case basis. It is also unclear that what works for a single-family, detached home is the same thing that works well in a dense, urban setting where you have apartments up a high-rise.

The same questions should be asked for the individual device. So the home could be wonderful in power line communication sense except the thermostat is not sitting on the power line. So we need a different way to reach that thermostat because, again, it doesn't sit on the alternative current wiring of the home.

The bandwidth of the application that we are thinking of. So again here by definition of how I scope the presentation is for relatively modest bandwidth applications. By that I mean a typical transaction is anywhere between a few bytes to perhaps a few hundred bytes. I would say on the outer side, when maybe you want to reprogram completely all the software that manages a meter or a thermostat you could be perhaps several tens of kilobytes.

But nothing like the megabits and tens of megabits, et cetera, that we think of when we think WiMAX or WiFi or these big things that we want to have on our PC to push a lot of data through. Big web pages or big e-mails with PowerPoint attachments and video and so forth.

Then there is the question at the bottom here of, how do I get into these in-home devices? Do I want to count on the AMI network as the one and only path to reach a subscriber's device? No matter how good, bad, big bandwidth, low bandwidth, et cetera, is that AMI. Or do I want to also take advantage of alternative paths inside the home, either broadband, DSL, cable or dial-up modem lines, et cetera.

In general, all of the public networking technologies tend to be IP based. So if you have any of the -- be it dial-up modems, DSL, cable, et cetera, your home is, as far as your PC, your printer and everything else, is home IP. So there is a case here to be made for adding other devices to that IP network.

Continuing the decision, criteria if you will. As I said, in some cases there are link layer technologies for which there is more than one upper layer networking technologies. 802.15.4 is probably the one that is the most prominent these days. And there's the, as it's called, 6LOWPAN, which is how to put IP version 6 over 15.4 as an alternative to Zigbee. Or to proprietary approaches of people who have done single vendor ways of driving data over that radio.

Things like home Plug, WiFi, et cetera, tend to be by definition TCP IP based because they were built initially for computing, which is IP-based, and then extending them to other devices prolongs the IP paradigm.

A key question that I am going to talk about a little bit here, which is, does the transaction between the utility central system and the intended target device benefit from being an end-to-end transaction and not mediated by any device in the middle? Or does it want to be one of a care-of, kind of thing, where the utility computer talks to some intermediate gateway, which then in turn has to translate it into some other communication technology towards that end device.

Because the utility computing environment is based on IP, because most of the wide area networks are based on IP. AMI networks, yes and no. Some of them are IP-based, some of them are not. The benefit of going end to end, and I want to maybe impress on that point, is if you take into consideration security, and you want to have an authenticated, non-repudiated and perhaps encrypted communication between the utility and the user's thermostat.

Doing this end to end leaves the whole patchwork of intermediary networks out of the picture. They don't have to know what encryption I am using. They don't have to know how strong it is. And only the user's thermostat has to have the secret and the utility computer has to have the secret, end of story. The meter doesn't even need to be in the way if it doesn't add value to that secure transaction.

As opposed to if you're going from an IP paradigm on the wide area side and then splicing that with a non-IP paradigm in the home area network. Now that device in the middle is having to do some translation and it has to be taking things from one format and converting them to another format. Which, you know, has its own issues of complexity and loss of information and perhaps keeping more pieces secure. So the network plays a more active and intrusive role the less of an end to end transaction approach that you take.

That brings also the question of, if there was such a thing as an intermediary, care of point of delivery that from the utility standpoint, what is that. Is it the pole top radio access point that's concentrating the meters in the AMI network. Is it the meter itself. Is it a new device known as a home gateway or energy services portal that lives inside the user's home or is it the device itself.

Or is it the communication sub-module that, you know. The famous SDIO communication module in the device. Let the user go procure his or her thermostat at their favorite retail store. And then you own the communication piece of that and you know that it's compatible with the rest of your network.

And then who owns the installation. So especially if this is a shared network. If we go with a home network that has not just the devices of concern to the utility but other devices that the user wants for their comfort or their home automation. Where does the sovereignty of one end and the other begin. So these are things to think about.

Why have I sort of taken an unequal among equals role towards IP. It's for the following reason. It's a little bit of a history lesson for why the Internet architecture has done so well. And I have taken a postal abstraction because I think it applies quite well to how this thing works.

The IP network works in a way in which the addressing and identification and routing towards all of the points that need to communicate is agnostic to how things are being transported. In fact, it can marry up many of those, radio, wire, fiber, cable, et cetera. And it is also not intrusive to what applications are riding on top.

And these are very much properties that we, in the postal system that we use today we take for granted. In that there is an abstraction called the zip code, the street address, et cetera. Which doesn't presume whether the mail is being delivered by bicycle or truck or airplane. Or all of the above actually at different legs in the journey. When I send a letter to somebody all I want to know is, what's their address. I don't want to get into the path of how the postal system is delivering it for every leg of the way.

Ditto whether I want to do a reliable transmission, an acknowledged delivery or an ad hoc, best effort thing, is left to each individual application. It shouldn't be the network that decides, any one size fits all.

And that's another beauty of IP is that you have very robust and flow controlled and reliable communications like TCP. And you have ones that are a lot more ad hoc like UDP. Very much like using certified mail with acknowledged receipt and signature of the recipient or, hey, send it and most of the time it gets there. And I'm happy paying only the 34 cents that it takes to get it there. I think it's more.

Do I want, with IP, to do end to end or do I want to use proxies? The beauty is IP allows you to do both. You can do end to end because it very much is about global reachability. But at the same time if for security reasons or care-of reasons you'd rather have a firewall or a network address translation -- we all have those at home behind our DSL or cable connections and that provides a level of isolation between what we do within the premise and what is visible to the public network.

Perhaps the strongest, single strongest point of IP is that it has co-opted every single, new communication technology that has been out there. We have gone from low-speed serial cables to fiber optics to coax, DSL, Ethernet, WiFi, cellular, all of those. And now 802.15.4, the low-power radio. All of those you can run IP over. And not only that, you can build a network that mixes and matches these as the economics or the distances or what's available out there tend to make judicious.

And as I mentioned it leaves the application to do what the applications want to do between the two end systems, using the network as a transport. In that sense the network is very much non-intrusive. You don't want the postman to open the letter and to see if you wrote it in English or French or Spanish. You just want the network to deliver it. And then you decide in what language you write it, whether you do A4 or eight and a half by eleven and a quarter. Your formatting, et cetera, is all yours. It should be application by application. You don't want the network to impose anything on you. That's how you get the maximum flexibility and that's why it has been so resilient and been around for two to three decades.

This is in a picture how it works. You've got to picture that the Internet protocol in the middle is what provides the common addressing, the common routing and reachability. Individual devices can take advantage of any of the plethora of boxes at the bottom. They could be, again, on radio, on Ethernet, on fiber, cable, et cetera.

And then think of it as a narrow waist where when you get to the top it starts getting wide again. And that you run any application that you please. And the only two people bound by the application are the two end points of communication. It is only the thermostat and the utility computer that have to agree on what format they need to run, how secure they want it to be and how reliable they want it to be. The network underneath ought not to impose any such consideration.

This is a pictorial view of what I mean by end-to-end versus slice. So if I picture the right hand side of the picture being the private subscriber network, like the home for example, and any of these wireless devices being say a thermostat or a load control module. And on the left hand side is the wide area with a central utility computing device.

What I have been talking about is whether from the computer to the user device we have an unmediated transaction. The network underneath is just there to reliably get it through. But I can pick my own security, I can pick my own formats, I can pick anything I like. and IP allows you to do that.

Or you can have a boundary device which the utility wants to consider as its care-of point of delivery and then have somehow this be conveyed back into the intended end device in some way that the user chooses or that the utility suggests to the user. You can still do that with RP.

But if the right hand side of the picture is not RP based you have to do that because now you are really converting between two incompatible addressing formats, two incompatible networking technologies, two incompatible transport mechanisms.

It requires you to think about whether you want the thing router device at the bottom of this picture, which is basically a packet flipper that gets things back and forth, just like our WiFi routers are and our DSL routers are, or something more intrusive, which now has to get in the middle of the transaction and translate it and keep it the same on both ends.

These are a lot of words that said, that tried to summarize why IP has done so well. And why somebody particularly who has a mind of several decades worth of investment protection wants to consider something that has withstood several decades worth of innovation and espousing what's out there.

That is why my recommendation is to really seriously think about using IP, especially now that it has been enabled and reduced to be very efficient on very low cost, very low resource devices, of the kind we want to see in customer premises. Again, like in-home displays, thermostats, control modules and so forth.

PRESIDING MEMBER PFANNENSTIEL: Thank you, very interesting. Questions? Yes.

CPUC COMMISSIONER CHONG: Okay, that was a pretty deep dive. I just want to say that for the record.

(Laughter)

PRESIDING MEMBER PFANNENSTIEL: Come on Rachelle, you're our standard bearer.

CPUC COMMISSIONER CHONG: Well I'm from telecom, this was a deep dive. Okay.

So there's movement towards the next generation of the Internet, the operating system.

Will that impact any of these types of decisions that you are talking about?

MR. ACRA: Yes. I presume you are referring to IP Version 6?

CPUC COMMISSIONER CHONG: Yes.

MR. ACRA: Yes, very much. In fact, it turned out that the way IP got standardized over 802.15.4 is to pick IP Version 6. So from day one if the vendors go with what is known as the 6LOWPAN, which is IP Version 6 over the low power area networks, is picked, they are ready for IPV6.

The way they are getting deployed today is what is actually running on the devices in the MESH, the thermostats and the meters, et cetera, is IPV6. And typically at the router at the edge of that cloud, if you will, has the ability to translate that to IP Version 4, the current Internet protocol. Because that's what 99.8 percent of the world is still running.

But the day the upstream networks and the utility computing infrastructures do get upgraded to IPV6 then you turn off that translation and it just flows through IPV6 into it. And the reasons for that, by the way, just maybe for incidentally, is that you have a lot more addresses. You have a lot more address space with IPV6 and they auto-configure themselves much better that way.

PRESIDING MEMBER PFANNENSTIEL: Thank you.

MR. ACRA: Thank you.

MR. G. TAYLOR: Next up I would like to welcome Rick Boland.

MR. BOLAND: Good afternoon, Commissioners, staff and participants. I am here today to speak in very general terms about one-way communications and using it for the potential for demand response.

My remarks are going to cover four types of communication technologies that are currently available in the marketplace with long histories. FLEX paging, FM RDS, which we have heard about today. SMS cellular technology and satellite radio.

The characteristics of one-way communications in this context are messaging abilities with no message return confirmation. So in the previous speaker's postal example, this is regular mail without return receipt. These technologies are widely used today, as I mentioned earlier, for both audio and data content delivery. And they are done in different ways.

They are mature. When I say plug-in and turn-on technologies, that means you buy a device, whether it's a cell phone or it's a radio, a satellite radio or a regular radio or a pager. They typically plug in and are enabled and work right away. They don't have to have any sort of installation associated with it.

One of the beauties about one-way communication is that it's a point to multi-point, a broadcast sort of approach that has wide area coverages. It does not, in these cases, require a meter, a home network, Internet connection. This is just a wireless technology. Again, back to the broadcast description. And they are presented today as low-cost alternatives to two-way systems that might be deployed in either demand response or AMI applications.

Starting with FLEX paging. FLEX paging has been around for a long time. It's a one-way communication from a paging provider to a receiver or a device. The messages are transmitted by either a transmitter or a satellite or a combination of a network. And the receiver might be a pager that we always think of on our belt or in our pocket or a purse. Or a paging module inside of a thermostat or another device for utility applications.

A characteristic about FLEX paging that is good is it's very addressable and it allows building penetration. Even in a building like the Energy Commission that has some difficulty with penetration.

One thing that is a negative about paging is a trend that with the advent of the cell phone paging is now being relegated to sort of niche markets. Whether it be emergency response, whether it be medical response. And we are still using it in the utility business as well for demand response.

Another characteristic of paging that has some attributes that are somewhat negative in that in rural areas there are limited availability for the signals. So if you look at a statewide map of California, for example, you would see the population centers are heavily covered with paging. But once you get into more remote areas then there's a lack of signal.

This also is based on proprietary

protocols that have been developed some years ago by Motorola. And the last point I want to make on paging is that it is an inexpensive solution from a bill of material perspective. Somewhere in the $5 to $10 range, depending on how it's configured.

The next communications technology is FM RDS. And FM being FM radio broadcast. So this technology emits from an FM radio station. And it is one-way again. Sent from the radio station to an RDS receiver. And an RDS-enabled receiver would be something like a car radio that has a song title and artist name as you're driving. It's a mobile application.

Another application would be, for example you're going to see next some RDS-enabled thermostats being demonstrated.

The technology has been around since generally the mid-80s or so. It's a open, global standard. It's widely adopted by the automotive industry for things like song title and artist and other information on the radio. But it also now is moving to include navigation systems, the ability to show real-time traffic as an overlay to a navigation map in your car.

It also has good building penetration.

And unlike paging it has remote area coverage. So if you think of a radio station. For example here in Sacramento there are currently two radio stations that have been equipped to send RDS signals for Title 24 testing purposes to a PCT.

If you think of the wide footprint of the entire market, those radio stations will cover the entire market. And the best probably comparison is, when you drive your car you will drive in and out of reception areas for various markets but it has complete market coverage, depending on the configuration of the radio station.

Another characteristic that is good about RDS is the messages can be delivered securely and minimal latency. One thing you are going to see in a few moments is Karen Herter will be executing a command for a demand response, for a messaging event, and it will show up near instantaneously on this thermostat that's equipped with an RDS chip.

Redundancy during power outages we think is an important characteristic as well. And when I say that, that means that radio stations typically have a backup power system. They are either a diesel generator or battery packs or however they do it. Radio stations typically tend to stay on the air, even if there was an electrical grid problem. And that would allow with the battery backup in a thermostat, the ability to receive a message during a power outage.

As I mentioned earlier, this is a pretty ubiquitous technology in terms of the auto business. The statistic that we like to use, that it's ion at least over 20 million vehicles that are on the road or have been retired from service.

However, one feature is there's limited utility use cases. Currently right now the company I'm involved with, we have a pilot programs and testing programs in California, Ontario and soon we are going to Texas with this. So there are limited use cases and installations.

Price-wise the bill of material cost for the RDS chip set module is less than $5 in quantities.

The next technology I would like to just speak briefly about is SMS and cellular telephone technology. And this is a one-way or a two-way delivery of messages using cellular telephone networks and related infrastructure. It comes in both an analog and a digital flavor based on an open, global standard. And it typically requires a subscription agreement.

(Whereupon, CPUC Commissioner Chong exited the meeting room.)

MR. BOLAND: And the best way to think of this sort of technology is something like an On-Star or emergency assist program that might come in your vehicle when you purchase it new. There are companies like On-Star and another company called ATX that use this technology to send robust data to a vehicle, primarily a vehicle for automotive telematic applications.

It has good signal coverages, has addressability. What it is not known for is its use in the utility industry.

Then the last technology I would like to cover is satellite radio. When I say satellite radio it's a digital one-way communication from a satellite or a repeater to a receiver. And there are right now two companies in the United States, SIRIUS and XM. There will soon be one company in the United States that will be the satellite radio provider. It's an FCC -- All of these technologies are FCC licensed as well as satellite radio.

Satellite radio, you might be surprised, delivers both audio and data. It, in fact, can deliver data that updates traffic information onto a navigation screen as well.

It's a subscription-based service.

It has a national footprint, a wide, national footprint.

It has addressability down to the individual unit.

But it doesn't have good building penetration. So we couldn't receive a signal off of XM or SIRIUS inside this building today. It does rely upon some repeaters but it is typically a line of sight sort of application. So if you are driving in a city and you have some shadowing off of a building. Or if you even drive under an underpass on a road, your XM or your SIRIUS service may cut out for a split second.

These are based on proprietary technologies. And right now they are not currently used in any research we found that people are using over-the-air satellite radio for utility applications.

And that concludes my remarks for today.

PRESIDING MEMBER PFANNENSTIEL: Thanks very much. Comments, questions? Art.

ASSOCIATE MEMBER ROSENFELD: You talked about emergency signals. Virtually that you could send out warning signals of various sorts. In the context of PCTs.

MR. BOLAND: Yes.

ASSOCIATE MEMBER ROSENFELD: With their display, limited display capabilities and so on. Can you give me an example of what will be an important emergency signal or emergency warning or idea.

MR. BOLAND: Sure. I would actually like to expand upon that for just a little bit. In the case of an emergency, it could be a severe weather emergency. In a place where you may have hurricanes or tornadoes, you could send a message to be received by a PCT that would say, take appropriate cover. There is the ability to send a freeform message on the PCTs that you will see here today. So that's one example.

The second example that is contemplated is more community oriented. So it could be anything from an Amber Alert to the high school football score from Friday night. Or, you know, snow emergencies and parking restrictions. So there's a lot of variability on how you can structure messages, both from the emergency side and from the community side.

ASSOCIATE MEMBER ROSENFELD: So does that suggest that on our specs for the PCT there should be an extra ability to flash a red light, which calls your attention to a signal on the display panel?

MR. BOLAND: I am not going to define the spec but that would be useful, certainly. Because these units have the ability to display a scrolling text, freeform text message. So there should be a method to direct the consumer to the device to say, you have either an emergency event or a message that might be an emergency event. An emergency energy event or an emergency notification of an event that might be, for example, weather-related.

ASSOCIATE MEMBER ROSENFELD: Could I ask Ron Hofmann who is sitting over there. When you talked about your human interface, Ron, you suggested a red button and a light which said, I am getting a signal. Has there been any discussion of an extra light which says, emergency message for you?

MR. HOFMANN: I believe that Erich Gunther proposed at one point that you could use the red light on full-time for one kind of a signal and flashing for others. And one of the applications that he talked about was, if it was flashing and the message was on there the flashing might come from the utility and say, even though you don't have power we know you're out. There's somebody coming within the next hour, your power will be restored. So if it was a flashing light it might mean one thing. If it was one full-time it might mean something else.

There's also the possibility that once you have the flashing light on there you can have different kinds of messages on the existing display, which tell you what kind of a message it is. So there's a number of options that are all software driven. Does that help?

ASSOCIATE MEMBER ROSENFELD: Okay. Thank you, yes.

ADVISOR TUTT: I had a couple of questions related to the RDS. You mentioned that it delivers secure messages. What is the security that involved there? No one else can send a radio signal on that band or what?

MR. BOLAND: It's the ability to encrypt the message content.

ADVISOR TUTT: Okay. And then I had the question about relevancy. Here in Sacramento I may be listening to an FM radio station but I live in PG&E service territory. So if a signal is sent out by that radio station how do I -- how does my thermostat or something else in the home know where I live so that I get the right message?

MR. BOLAND: The software architecture, and this is not going to be an advertisement for our company, but we developed software architecture to transmit and receive messages. And we have the ability to determine if you are in a PG&E service area or a SMUD service area, for example.

ADVISOR TUTT: That almost sounds two-way.

ASSOCIATE MEMBER ROSENFELD: Yes, that sounds too good to be true. Can you say a few more words about that. Here I was thinking I understood what was going on and I am now confused.

MR. HOFMANN: The published standard has a four level addressing system. The very first level identifies which utility the signal is coming from. And so if you are in a particular area and you have a registered thermostat with PG&E it will only listen to PG&E messages, no matter what radio station it's coming from. It will probably be listening -- It will probably self-tune itself to the strongest message.

But the addressing actually has five layers but the four layers are in the back. I understand there is a fifth layer that was proposed to have the actual zip code of the individual. But when you register the device you will be registering it as part of Southern California Edison or whatever. You personally. You don't have to have the utility do that.

ASSOCIATE MEMBER ROSENFELD: So I guess I understand it. This is one-way-plus. That is, at the very first stage when you register it, it's two-way via a telephone or via something so that the thermostat is told you're a PG&E thermostat or you're a SMUD thermostat.

MR. HOFMANN: Several registration methods were proposed. Some of them being that you call your utility and they tell you what to do to your PCT to register for their territory. Other people have proposed methods where there could be a code on your bill. And that code is punched into the keypad and that does all of that. They have been calling it the credit card verification or registration technique. But none of them have been picked yet by the utilities. So I don't know which one they are going to choose.

ASSOCIATE MEMBER ROSENFELD: But that's the partial two-way, to add to Tim's comment. It's a one-way 99.9 percent of the time but it's two-way at the inception for what's necessary.

MR. HOFMANN: The two-way goes back to the telephone.

ASSOCIATE MEMBER ROSENFELD: Yes, thank you.

MR. BOLAND: If I could add onto that, Ron's comments. In the case here where we have a PCT being demonstrated with a live, over-the-air signal from an FM station in Sacramento in a few moments. That is not interrupting the current SMUD pilot program that is ongoing. It is receiving messages only designated for the group of messages that -- or group of thermostats that would be applicable to those messages.

ASSOCIATE MEMBER ROSENFELD: Great.

MR. BOLAND: So the pilot program is not going to be disturbed as we sit here and make this thermostat work. Because of the ability to add groups and segment messages by those groups.

ADVISOR TUTT: I have one follow-up question. Again, living in PG&E service territory I bought a thermostat. It seems like most of the highest signal, higher power radio stations might be SMUD area. How would my thermostat self-tune to the right radio station? It would have to be a registration process.

MR. BOLAND: Well, the receiver technology itself embedded in the module will scan the dial looking for data. Title 24 data. The architecture that would be proposed for the statewide network, of course, would have no holes in coverage for the majority of the state. So no matter where you are you can plug it in. It would find the messages for your area.

MR. DAVIDSON: Mike Davidson from --

PRESIDING MEMBER PFANNENSTIEL: I'm sorry. If you are going to ask questions you need to go to the microphone. There's one right in front of you. And we are not really opening for the audience questions but go ahead at this time.

MR. DAVIDSON: If anybody is interested after this event I've got some --

THE REPORTER: I need you to identify yourself for the record.

MR. DAVIDSON: Mike Davidson from Wessex Consult representing the Australian Greenhouse Office. I can provide information on trials of RDS technology undertaken in Australia successfully.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Thank you.

MR. BOLAND: Thank you.

MR. G. TAYLOR: As has been alluded to a number of times, we now have a demonstration of an actual functioning PCT. I would like to welcome a small team of people including Karen Herter.

I just want to make a quick announcement while they are setting up. All of the presentations that you have seen today will be available on our website, probably by COB or definitely by COB tomorrow.

In addition I encourage everyone who is here who might have something to say, we will --

we have about two hours before the end of the day here. So if you do have something to say please make it brief but we definitely want to hear in entirety what you have to say. So please submit it in writing to the record. The deadline for comments on this workshop is next Thursday, about a week from now, as published in our notice. But in addition we will accept comments past that period on the proceeding as a whole.

DR. HERTER: Hi, my name is Karen Herter and I work for the Heschong Mahone Group in Fair Oaks, California. I was asked to do a technology evaluation of the RDS technology and also the PCT technology by the Demand Response Research Center, which is, of course, funded by the Energy Commission and PIER program.

So what I am going to do is first I'll give you the results of my study and then I'll go straight into the demonstration.

The first step in the study that I did was to look at the RDS technology itself. And so I worked with Rick Boland, who just spoke, and e-Radio. They set up station KXJZ, which is 90.9 FM, with the technology that's required to send an RDS signal.

The first step was to take an RDS monitoring system and drive around, essentially Sacramento. We stopped at 40 different buildings, some residential, some small commercial, it was a mix. And we tuned our monitoring system to the 17 different radio stations that are already broadcasting RDS in Sacramento. KXJZ is just one of those stations.

And we recorded the number of correct packets. There's error correction in the sending of the RDS signal. And we only recorded those that came with -- the full packets that came in. And then we did a probability analysis of that data collection to determine what the probability of receiving a signal at any of those 40 sites would be.

So the results showed that we received a 95 percent probability of reception at all sites in one of two cases. The first, if we sent the signal over KXJZ and repeated it 55 times, which would take about four minutes, then there's a 95 percent probability that all 40 sites would have received the signal.

Alternatively, we could have repeated the signal just five times, which takes about 20 seconds, on two different stations. And 90.9 and 100.5 FM were, both of those, set up to send RDS signals. At this point only 90.9 FM is set up. There's one more station. Is it 89.5?

MR. BOLAND: No, 88.9.

DR. HERTER: That's 88.9 that is in the works. Are there any questions on that?

The second part of the study was to work with the local technology, a local thermostat vendor, Residential Control Systems. They are about three miles from where I am so that was very handy. They are one of the only manufacturers that are currently working on programmable, communicating thermostats. We'll hear from a couple. We have also mentioned Tim Simon and Golden Power.

And so we worked with them for a couple of months on getting their thermostat to incorporate the RDS receiver and to use the protocols over the e-Radio system to receive and respond to a demand response signal.

We only tested the basic functionality. We didn't test, go through all of the steps of the Title 24 specifications, mainly because it's still up in the air. For example, the addressability couldn't be tested until we know what the specs are on that.

So all we tested were the ability to send a signal, to receive the signal by the thermostat, and for it to respond accordingly. For both a price signal and for what we are calling a temperature change signal, since it is not clear whether it will be an emergency/non-overridable, or a emergency/overridable signal at this point.

At the end of the study we determined that the thermostats that RCS has produced do respond in the way we would expect them to respond and with any luck they will respond in the way we expect them to respond right now.

One more note. We do, as was mentioned earlier, I have a pilot with SMUD. Thank you SMUD for being here and for working with me. We have about 80 of these currently in the field in small commercial businesses. We have successfully tested two events. Not real events but one message event and one test event at this point. Both successful. And as soon as we get another good hot day we'll have the real, the real deal.

But this is just a one-summer study.

We'll be testing price events and temperature change events. We gave the customers a choice between the two. At this point about two-thirds have chosen the pricing program, about one-third have chosen the temperature change program. And we'll have results of that, it's a behavioral study, at the end of this year.

For more information on the technology evaluation which has been completed or for the pilot you can look on the DRRC website, which is not, unfortunately, listed here. But the PIER final project report for this technology evaluation is listed here. Or you can always contact me and I would be more than happy to give you that information.

And with that, this is Mike Kuhlmann and team to give us a demonstration on how the PCT works.

MR. KUHLMANN: A little bit of a setup for what you are going to see here. We have a couple of -- we lost some of our commissioners, I see. Are they coming back?

ASSOCIATE MEMBER ROSENFELD: She'll be right back.

MR. KUHLMANN: All right. Good, Art.

This, as Karen said, is an actual, live trial that's going on in Sacramento courtesy of SMUD. We are using an interface to that through a web interface. This was provided by e-Radio, to talk to the actual radio transmission center and issue, initiate and issue live events across the RDS network.

So the background screen you are seeing there is the event controller on the live radio system. We have superimposed on top here a video display of our thermostat screen. This thermostat screen has a graphical display on it so we are able to do a lot of, represent a lot of information. Right now we have got it set to a Cool mode. We set it at 68 degrees and you can see the fan is running over there, which is hooked to the actual thermostat.

So we are going to initiate an event here. A critical peak event. And I can show you before we do that real quick, by going to the menu, where we have set up the utility interface on here. And for that critical peak or Tier 4 offset we have got a four degree offset. We have got a four degree offset set on the thermostat.

All right. So now let's go ahead and

initiate an event. Again, through this web interface. And you'll see a series of screens come up that represent and tell the user what's going on. What's happened. If there's an event in progress, okay. So we just got a notice. That came in live over the air. The thermostat has responded that an event is scheduled.

So if they walk by their thermostat and saw the flashing red screen they would know that something is going to happen. And then can see when it's going to happen on here. There is going to be a Tier 4 event, a critical peak event, occur at 2:59 p.m. It is going to start and it is going to stop at three.

ASSOCIATE MEMBER ROSENFELD: So it's going to last one minute?

MR. KUHLMANN: It's going to last one minute.

DR. HERTER: Unless you hit a button.

MR. KUHLMANN: We can override this. But I want to let this event go through completely first and then we'll go through a couple of -- So the event just occurred. It shut off the fan, which is representing the thermostat at this point. So we have done that through a transmission through the local FM radio station, over the air, received by the thermostat.

It altered its program to say -- let me see. If I go in here I should be able to see. The thermostat has been set up to 72 degrees, which is an offset, the four degree offset that we had programmed into it.

It will continue in this mode letting you know that it is in an override until the event terminates. At which time it will tell you that. Which should be here shortly. We can only do these in one minute intervals so bear with us here.

ASSOCIATE MEMBER ROSENFELD: I think we can afford another 15 seconds.

MR. KUHLMANN: All right, very good, very good. All right. So we should be timing out here any second now and the event will terminate.

MR. GOODELL: So these two heating contractors go into an Energy Commission meeting.

(Laughter)

MR. KUHLMANN: He's our straight man.

We do have the ability to -- there we go, all right. So the event terminated. We've got a notice from SMUD that comes in that says, normal operations resume. The thermostat kicks back on, thank you for your help. So you know exactly what happened. The information has been conveyed to you on the event status.

DR. HERTER: And I want to stress here that the four degree offset was programmed by the customer because this is a pricing program. Now in the event that the customer doesn't want anything to happen, today is Granny's birthday, we're having a party, so we are just going to ride through the prices. We don't want to respond. Then you would go in and set the Tier 4, which is the critical offset, to zero.

Our next demo is going to show how when we send the signal this time the thermostat will not respond.

MR. KUHLMANN: We've set it to zero.

ADVISOR TUTT: Suppose the customer has forgotten to do that and Granny is there and is roasting. Or at least the thermostat is flashing.

(Laughter)

ADVISOR TUTT: What can they do then at that --

MR. KUHLMANN: We have a set of slides for that as well.

ASSOCIATE MEMBER ROSENFELD: Thank you for asking that question, Tim.

DR. HERTER: You can, you can just hit the up or down button, whatever you like, and change the temperature to whatever you like at any point that you like.

MR. GOODELL: It doesn't lock the system out. It's still back to you. You still control the system. You would walk by the system in the hall. There --

THE REPORTER: Please identify yourself for the record.

MR. GOODELL: I'm sorry, I'm sorry.

THE REPORTER: Thank you.

MR. GOODELL: Okay. Gene Goodell, RCS.

The notification would be active in the hall. The light would be flashing, the thermostat would be interactive. And then they could at that point say, whoa, we've got a party, I forgot to change out the setback. I can change that right here real-time and not affect the system.

MR. KUHLMANN: What you just saw him do there, the Group ID. That was what Rick was talking about earlier. That's how we identify what group of the thermostats -- Karen is running a live test as a Group 1 right now in Sacramento. We have a special channel set aside for us for Group 50 for testing and for prototyping and for demoing like this.

But each thermostat can have its group ID set in it. Which allows you then to be a part of certain groups, certain utilities to identify what group you're in.

Okay, so we have got another event scheduled now. Again we're on a one minute interval. So this event will trigger -- This time the fan won't go off. And then we'll quickly demonstrate -- Okay, the event is in progress now. You saw no change in the operation. There is no change in the set point. So essentially the thermostat, because you've set it to be a zero response, has ignored the event, essentially.

DR. HERTER: Even though there is no offset in this case the notification still comes through. Because keep in mind that the customer can still respond to the signal in other ways. Since it is a price signal the customer might want to take other measures other than just affecting their AC. They might want to, whatever, turn off lights, the television, not use the microwave, not do the dishes right now, do them later. And so the thermostat is a way of -- in this case it's just a notification method, which is also very useful for a pricing program.

ADVISOR TUTT: Can the customer stop it from flashing?

DR. HERTER: Yes, you can just push a button. Push a button, would you. There you go.

MR. KUHLMANN: All right. Now we're going to do an event where we are going to override that event. Let the customer override it dynamically on the screen.

So we programmed back in the four degree offset, which will cause it to go into an event. But we are going to allow him to walk up to it and override it.

Okay. So I have attempted to override the set point. It gives me a message that says, lowering the set point will override this event. Are you sure you want to do this?

If I answer yes then it will override the event, we'll be done with it. Or no, it will go back into that screen that was indicating the event was in progress. So I essentially terminated the event at that point.

A couple of other things we would like to show you real quick about this. Let's send a message. So as Rick indicated also, the RDS network is capable of sending text messages, pre-canned messages. It can be used as a general purpose messaging device for customer information. We are going to send a message here that -- the public safety message, okay.

So here is an indication where for some reason there was a public safety alert that needed to be sent out. The thermostat can be used to send that over the network as well. So that message came again from the RDS network, to here, to be displayed on the customer's screen.

ASSOCIATE MEMBER ROSENFELD: How come it's not red to get my attention?

MR. KUHLMANN: It's programmable, Art, programmable. So if you'd like it to be red we can do that.

MR. GOODELL: Or pink or chartreuse.

MR. KUHLMANN: And I think that's the concept that Ron is trying to get across is the fact that the technology is neutral. The devices are capable of doing and carrying out any kind of a strategy that you'd like. Which gives us the ability then to alter that as we go down the road to find out how to make it more useful or more beneficial, or get the response we want from the consumer.

This type of a display can also show you other things. I'll show you a couple of screens. We can actually monitor the HVAC usage right on this device. Show things like pricing information. Usage information. History of month's use, week's use. The point being that the device becomes more than just a thermostat control, it becomes an energy manager for the house as well. So we look to merge those technologies back together again.

That's all we've got. Any questions?

ASSOCIATE MEMBER ROSENFELD: Yes, I have a question. This is about ready to go on the market once we decide a few more protocols?

MR. KUHLMANN: Yes, we're ready. In fact, this stat is being used, it's being sold today, both directly from our company. It has been on the market for several years. The interface to the RDS radio is a module. It's a little radio module that we plug into it. So like the PCT concept we can add different kinds of modules to this thing to support RDS, Zigbee, Z-Wave, WiFi. Whatever protocol becomes the required protocol for your application. It's available today.

This is being sold, as I mentioned. Some of you are familiar with the GE Eco-Imagination home program. This thermostat is being sold into that program along with the touch screen to show usage data in the homes. There are roughly five communities that are under construction, another five will be started by the end of this year. Representing about 20,000 homes will have this technology in them.

PRESIDING MEMBER PFANNENSTIEL: Great. Thank you. Very interesting demo. A great little device.

ASSOCIATE MEMBER ROSENFELD: Remember the flashing red screen. That's more attention-getting than Ron Hofmann's flashing little light.

(Laughter)

PRESIDING MEMBER PFANNENSTIEL: Thanks, thank you all. Thanks, Karen.

MR. G. TAYLOR: Next up we are going to have -- Let's see. SMUD I think rightly goes next after the SMUD demonstration of technology to discuss their energy management technologies and programs. And then we are going to have the three IOUs come up and each give us a brief overview of their current energy management and load management programs. I think we are going to do this one as a panel discussion, if the four of you would like to come up to the table.

PRESIDING MEMBER PFANNENSTIEL: And I'd suggest, as people are coming up and getting started, that we are running a bit late. So I would ask that the utility panel try to be efficient in your time so we have time following this for some public comment and input to us. So come on up.

MR. G. TAYLOR: Have a seat at the table. The microphones are live.

MR. PARKS: Good afternoon. I'm Jim Parks with the Sacramento Municipal Utility District. I have been asked to talk about SMUD's load management programs and enabling technologies. I've got to tell you, I think our existing load management programs are nice but I would rather talk about the direction that we want to go.

We basically have three load management

programs right now. One is our air conditioner load management program. It has between 110 to 200 megawatts depending on the temperature. It has been a successful program but the technology is over 20 years old.

In addition to that we don't really know how many devices have been tampered with or things like that, how many of them are actually functioning. We know that when we do a notch test we see good savings, we see a big reduction. But I think with the new systems that are coming into place with advanced metering infrastructure and so forth, if someone tries to tamper with the device we will know right away whether it is functioning or not. So there will be big advantages in the future.

Our second program is our voluntary program. This one is super high-tech. We call our customers and say, can you turn off the loads that you agreed to turn off at the beginning of the year.

(Laughter)

MR. PARKS: And we actually have 45 megawatts on that. You know, as simple as it sounds it really does work. And we talk to our customers every year and say, look, last year you said you'd shut off two megawatts, are you still good for it? And they say, yeah, we're good for it. And then the end of the summer season we put an ad in the Business Journal thanking them for their participation. It really does work.

And then we have eight megawatts on two programs that we call Power Net and Power Direct. And these are basically Internet-based programs where we can send a price signal over the Internet and they can choose to respond.

I'd love to tell you that program has been a smashing success but I think the good thing is that prices have not been high enough for us to send the right signal to generate a response. And so when we tested the program at $250 per megawatt hour we got a great response. But try testing it at, you know, $50 a megawatt hour and the response dwindles dramatically.

I'd shown this slide earlier. The Smart Grid Vision. I don't really want to spend a lot of time on it in the interest of time. But I am not going to go as fast as I did last time.

One of the technologies we see coming, and a major thing for us, is going to be automated metering infrastructure. We've talked about this a couple of times before the Commission so I'll just point out a few of the things in red.

That we want to have the interoperability, have the protocols. We want interoperability in the home and business area network. And we want to be able to enable communicating thermostats and get efficiencies throughout our entire system as a result of this.

Our proposals are due next Friday. So we will be evaluating the proposals and making a decision how to proceed from that point on.

We also want to use the technology to leverage our existing programs. Actually to transition them to the new technologies. You know, like I said, our air conditioner load management program is great but it just really offers, you know, off and on.

And I like the idea of being able to offer a few degree temperature setback or a full shed or a shed for 10 minutes or 20 minutes, whatever we decide to choose or the customer decides to choose. It will give us a lot more options.

And I think it will actually expand our

customer base on these programs. Right now we have about 110,000 customers participating in the ACLM program out of about 560,000. Which really isn't a bad number when you consider that a lot of the 560,000 are apartments and multifamily and things like that. And there might even be a few homes in Sacramento that don't have air conditioners yet but we have pretty good participation.

We also want to develop what we are calling the non-incentive programs. And this is where you send, you know, price signals to customers or you have in-home monitoring devices. Where they shed load on their own and we don't really have to pay them for that. And those are some of the things we see coming in the future.

But we want to be able to drop load at the feeder level, which will give us greater control. And we see the advanced metering infrastructure enabling us to do that. Where we can do measurement and evaluation and determine, you know, do some statistically significant samples to determine what types of loads we get per customer.

Then you know how many customers are on

a specific feeder. So if you've got a feeder that's overloaded you can just shed the load on that feeder, as an example. So you have much greater controls as a utility.

Whereas right now we just push the button and turn off all the air conditioners. And sure, we get some level of drop on the feeder in question but we don't really know how much that one feeder is being impacted. So this will give us greater control.

We also want to monitor the statewide activities with respect to AMI. For those that are preceding us we say, good job, keep up the good work and share the information that you're learning from that and we will do the same. I think it's good for us to learn from our success stories as well as our failures. Generally we learn more from our failures. And I hate to say this, my friends, but I hope they happen to someone else so that we can learn from them.

(Laughter)

MR. PARKS: And then continue research on pricing and enabling technologies. We have got a lot planned. We have been presenting different pricing structures to our board. We're looking at time of use rates, critical peak pricing. And we are doing some tests in those areas also and Karen talked about some of that.

Three of the research projects we have going on right now are the Power Choice where we are using advanced meters and in-home displays so that customers can better see what their energy use profiles are and make adjustments on their own.

We also have a similar project in the small business arena and we are also using the programmable communicating thermostats in that one. And so once again we are able to test some of these rates with our customers so that we can see long-term what we want to do on a wide scale. I know the SMUD board in particular is kind of sensitive about customer opinion and we don't want to deliver a widespread rate that's just going to create great unrest in our utility.

And then the third project we have going is a near-zero energy home display pilot. We built some homes a while back, a few subdivisions, that are about 60 percent more efficient than building codes when you factor in the photovoltaic arrays. And we want to install advanced meters in some of those homes with in-home displays that will allow the customers to see how much they are generating and how much they are using. And see what kind of savings we accrue from that.

The next project we're working on is what we are calling an Eco-Smart home. This home is about 80 percent more efficient than code. It is under construction right now in Folsom. The framing is up, the outside paneling is up, the insulation is in, the wiring is in. It's going to be hopefully finished in time for us to get a few months of summer data on the home. So a really tight shell.

And we are going to install different things in there like -- what's the -- energy storage, that's what I was trying to think of. So that we can simulate like vehicle to grid or vehicle to home. We see plug-in hybrids as kind of a wave of the future for us.

We think we are going to see thousands of those in the future as gas prices continue to climb. People are going to move to plug-in hybrids. There will be opportunity for people to charge off-peak at low cost and then return that energy to the grid during periods of high cost.

So we see a lot of opportunity there.

We talked about that.

The other thing we're doing is some energy storage projects. We have a Vanadium Redox Battery system. It's a 20 kW system that we're testing now and we've got another test going on where we are really benchmarking and seeing where we can use larger scale energy storage on the distribution system. This comes back to working with distribution systems that are overloaded. Maybe we could do one or two megawatt scale batteries in there.

And we are also doing the tests on our zero energy homes. We really want to simulate the vehicle to home or vehicle to grid.

And then lastly we have a project that we are doing with the light rail here in Sacramento, ultra-capacitors. And basically it takes the braking energy of the trains as they pull into the station and stores it in the capacitors. And then as the trains pull out of the station the capacitors deliver energy to those trains.

Lastly, this is just showing what happens with -- what we're looking for with our vehicle to grid or vehicle to home and charging with meters for the plug-in hybrids.

But really what I want to say in conclusion is I think we haven't really mapped out our load management programs that we're going to have in the future. I think technology is going to determine that. The results of our pilot test are going to determine that. We are just going to do a lot of demonstration projects and pilot testing to determine what the right mix is for us in the future.

I think there's kind of an 80/20 rule that I look at in this situation where we can try to get that last little bit of savings but it is going to cost you 80 percent of the cost. And I think we need to find that crossing point where we get the maximum benefit from these technologies.

So with that we'll conclude, thank you.

PRESIDING MEMBER PFANNENSTIEL: Very good. Thanks, Jim.

ASSOCIATE MEMBER ROSENFELD: Jim, I have a really dumb question but I'm a little surprised that it says 110 volts there. I would have sort of thought if you got into charging a car you would use 220. Don't most homes have 220 these days?

MR. PARKS: Most homes do have 220. And it may move to 220. It depends on the capacity of the battery. Some of these batteries are down to like the -- I forget the ranges. But there's a real range of battery pack size. Some of them it will be okay to charge them on the 110. Some of the larger battery packs you may need the 220. It's still kind of to be determined.

ASSOCIATE MEMBER ROSENFELD: Thanks.

MR. TANG: Good afternoon, everyone. I am Andrew Tang and I am with the Pacific Gas and Electric Company. And I manage a group called the Smart Energy Web. So under my responsibilities it includes the demand response programs, the smart meter upgrade program, and the clean air transportation or clean vehicles, alternative vehicle fuels program.

I would agree with my colleague from SMUD about how I do want to focus on the forward progress but I thought just taking a quick step back and talking about the enabling technologies of the past.

You know, our first demand response program, our first interruptible rate that we had dates back to 1959. And that was -- And really the programs historically were based on a notification-only type of basis. And the technology that we used was the good old telephone. So we could call people up and we could tell them to please shed load.

In 1976 the CPUC adopted staged emergencies. Well then we had emergency notifications.

In 1998 we really started to step up the technology and suddenly we had the ability to notify our customers that participated in any of these programs with either pagers or faxes.

And really was started to change was obviously the advent of the Internet in the late-'90s and early 2000s.

And what that really brought to us was this new, this new braver world where we have the concept of notification and control. So for the first time not only could we notify people but we could actually take actions as opposed to just hoping, relying on the kindness of strangers or friends.

And so this yellow box is our AutoDR box. This is a -- We heard from someone else in the audience about the OpenAMR protocols, of which we adhere to. But this is our AutoDR program, this is for our large commercial customers, where the notification is actually received over the Internet. And it's pricing signals and policy happens. This device then serves as the energy gateway within that customer and actions will happen. So load will be shed automatically without human intervention.

In 2007 we launched our Smart AC program, which is an AC cycling program. And we have actually two devices that we use in our Smart AC program. We use both a programmable thermostat, a programmable communicating thermostat, and then we also use a switch that actually happens at the compressor.

And as we look forward into 2008 and beyond we really see the opportunity for our smart meter upgrade program to really take the mantle for a lot of DR control an applications.

So taking a step back and looking where we have been. We had about 500 megawatts under control back in 1978.

In 1998 that grew to about 550 megawatts.

We are currently in the, roughly in the 988 megawatts of load that we can shed under our demand response programs.

One quick note. You will notice that we actually dipped in 2001 to 342 megawatts. This was directly a result of the energy crisis. What ended up happening was we actually used all 100 hours of our demand response time or our CPP time on our customers. We used all 100 hours that we told them we'd call them for by January 22nd.

And so what ended up happening was that the programs became so onerous from the standpoint of people being able to run their businesses that we had a lot of people leave our programs. They weren't flexible enough because of all the calls that we had in that first month. In the first 22 days of that first month.

And we just filed our demand response filing for our 2009 to 2011 portfolio. And our goal is by 2011 we are looking to have 1.3 gigawatts of load under demand response control.

So we've heard a lot from a lot of people in the audience today about the various communications technologies. What I would like to say is there are many developing load management activities, both demand side management and energy efficiency opportunities. And the common theme here is that a lot of these technologies require a two-way communications capability.

With all due respect, the one-way technologies and the ability to control your thermostat and to increase your temperature are all interesting. But in my mind they are a bit academic.

And the reason they are a bit academic is that we do not truly see the other side of the benefit unless we have concrete data that can really explain what the load shed is. And we share that with the CAISO. And the ISO actually does not procure the power. Because if the ISO continues to go and procure the power then you haven't actually achieved any demand response benefits.

The three California IOUs have agreed and really have centered around the communications infrastructure for the home area network. We have really codified around the Zigbee standard. A lot of that is primarily based on the fact that it is really -- first of all there is a cohesive alliance. It's further along in its development.

There is a cohesive alliance that is built around building the protocols. Defining the protocols for how do you control smart appliances. What are the actual commands and protocols that you standardize in order to control devices.

But having said that, on the home area network we have looked at a variety of technologies. Zigbee, 6LOWPAN, Home Plug, WiFi, Z-Wave, Insteon, would be examples of some of the technologies that we have looked at. We have heard a lot from people in the audience about Zigbee, 6LOWPAN and Home Plug.

And then on the Smart Grid side or on the AMI side we have looked at Powerline Carrier-type technologies, both narrowband and broadband.

We have looked at various radio frequency technologies. There's Fixed RF and then there's RF MESH.

And then we have looked at third-party type opportunities where we would have to partner with a communications carrier. So those would be opportunities like relying on the cellular companies like Verizon or Sprint. Or leasing lines from the fixed line telecommunications companies or looking at WiMAX as an opportunity.

Well the three California IOUs have really settled on radio frequency solutions for a variety of reasons. But really, primarily, because it is the right solution at the right price point.

The one thing, though, that I wanted to bring up and distinguish here is that this home area network is a very separate, distinct network. There has been a lot of talk about where is the gateway or this ability so that if someone buys a device or buys a thermostat or buys a smart device and they move within the state, they want this ability to make sure that that is not a stranded investment. That they can move from Northern California to Southern California, for instance, and still be able to use their energy management system.

The way we architected this, the HAN is completely separate from the AMI network. In our case you can almost think of it as the home area network has a back hall. And in our case the back hall is our AMI network. But there is nothing preventing that back hall from being the public Internet. There is nothing preventing it from being various Internet service providers. Or even the good old telephone line in a dial-up.

There's was one comment, one clarifying comment I did want to make which was there was a question about whether or not we can get the energy consumption data out of the PCT. And we had that very informative demonstration where we did see the energy consumption.

The one thing though to bear in mind is that was the energy consumption of the HVAC unit. This thing doesn't -- You have to be careful about how much we load up. How much capability we load up into this, right. Because you won't be seeing the $40 price point then, right.

The real issue is not just how much you're consuming.

ASSOCIATE MEMBER ROSENFELD: Sorry, I just didn't hear you. You won't be seeing the what?

MR. TANG: The $40 price point. In other words, if you want this device to suddenly really -- What you really want is not just the amount of energy that is being consumed by HVAC, you want whole house, right. You want the consumer or the customer to understand the impacts of his entire lifestyle, right. The fact that he may have a plasma television, and if he's got that turned on. What are those impacts. Not just the HVAC. That's only one component in a customer's total energy consumption.

You know, this device is basically a sensor. That's all it is. The device that gets you towards where we want to go, which is whole house energy consumption, is typically called a gateway. And we have had people from various companies come and present and talk to us about what the gateway can be.

We feel that our architecture that we are working on maximizes the flexibility. The gateway can be anything. We initially think that the gateway for PG&E-sponsored programs, we think the gateway will actually reside in the meter for our programs.

But there's nothing in our architecture that would prevent that. And in fact we have worked with companies in Silicon Valley and we have worked with venture capitalists to talk about what does an energy management system look like. There is a gateway device here. Or there could be a gateway device here. We don't have to get in the way.

So that would be the vision. And I guess the next question would be, what are the requirements to start making this a reality. And in order to achieve commercial success the home area network architecture, we believe at least, will need to adhere to the following tenets.

First of all, open architecture. So true IP addressability end to end. One thing to think about this. And I think most people, I think everyone in this audience is really -- I think this issue has now become almost just a truth, right.

But if you look at even in the consumer electronics space you actually had a, we have had 30, 40, 50 years of consumer electronics being fairly proprietary. And what you are actually now starting to see, you actually go and buy an audio/ video receiver these days, a stereo, and it actually has an Ethernet port on the back of it. You can actually plug it into your home network.

So as we have heard from people, IP has won. IP has really proven its resiliency. And Ethernet as the wired form of IP has also won in proving its resiliency. So we think that open architecture and Internet protocols are very important.

We think interoperability is absolutely essential. And we think that -- well one thing is, you know -- And I wish Commissioner Chong were here with her telecom background. But Metcalfe's Law. A very famous scientist, Metcalfe. He basically quoted a law which is sort of like a Moore's Law but the Moore's Law equivalent of the telecommunications industry. Which basically said that the value of a network grows by the square of the number of end points on that network.

So to the extent that we have interoperable networks, all using the same standard, and you have multiple devices out there in the home, the value of what you can suddenly do with that network just grows by a square factor.

I guess further, the install process on this has to be easy and simple. We have to avoid a situation where it requires a call to a help line.

Future flexibility. Another thing that I think we need to be careful of or mindful of is that while Zigbee does look like an emerging standard right now, we need the ability to make sure that we make hardware decisions that are relatively certain and provide the flexibility or the ability to make sure that changes can be accommodated in software. So this is typically in the industry called a flash download. The ability to flash download different software onto a particular chip.

So on that 802.15.4 chip that some people refer to. Do you put a Zigbee stack on it or do you put a IPV6 LOWPAN stack on it? Well, I want to remain as flexible and indifferent to that as possible, right. Because I want the ability to go -- If the industry takes a different direction I want to be able to go in that direction without having to strand assets and go back to my homes and replace hardware.

We are also working with both standards groups, with both alliances, both the Home Plug and the Zigbee alliance. And what we are actually doing is we made a proposal to the Home Plug alliance to harmonize the application layer of both the Zigbee, of both the Zigbee standard and the Home Plug standard.

Now what that means in English is what we are trying to do is make sure that people can develop devices and those devices will innately work, whether it's Zigbee or Home Plug. Now there has been a lot of division and a lot of fighting between those two industry groups over the past four or five years. And we are trying to bring them together to harmonize because we think that the right solution is actually a blend of the two.

Scale economies, I would say, are really, really important here. Really the issue here is in order for the PCT manufacturers to get interested in this space we have to make sure that there is a market opportunity. And not only that but we also have to make sure that we set very clear, technology requirements to provide device manufacturers with a very clear development path. So they need to see that the market opportunity is large enough and they need to see that the requirements are clear enough.

I would argue that Zigbee has achieved that point where the market size opportunity is big enough. Between the three California IOUs we have all committed to Zigbee. We have got 12.5, 13 million -- We have got a 12.5, 13 million household market opportunity right there.

The state of Texas actually enforced in their law mandated Zigbee under glass as well. So you've got all the households in Texas. And the country of Australia mandated Zigbee as well. So I would say that you have got an over 20 million marketplace opportunity in front of you with Zigbee.

And the reason I bring this up is because my last point down here which is, ensuring a large market opportunity with standardized interoperable product is what helps the manufacturers drive product. And what is critical to avoid at this point is what I would call, feature creep.

And what I mean by feature creep are hedging strategies. Okay, so we have heard a lot about well, what about in the interim time period. What do we do just in case the technologies don't evolve.

I would argue that the California market alone has created a market opportunity that's big enough for the Honeywells and the Tranes and the other PCT manufacturers to stand up and take notice and say that this is a market opportunity.

And what I would say is that if you have backup to backup measures, or Plan B and Plan C, all that does is it adds cost. Which we've heard from people that it might be a buck or two or three. But, you know, a buck or two or three on the bill of materials actually has a three to four to five X result on the retail price.

We also have, we also have a situation where you confuse manufacturers. Well I thought you had a standard. What is the standard? Which is it? Why do I have to put in both? It introduces delay because you confuse people and they say, format war. Why don't I sit back on the side.

This is VHS versus Betamax. This is HD-DVD versus Blue Ray, right? The standard approach that people take is, I'm not going to be leading edge. Let someone else sort it out, let someone else make the wrong selection. I'll wait until one selection is there and then I'll come forward and I'll make my solution.

So really to wait it out until a clear market and specifications emerge.

I guess one other thing I would like to talk about is that one thing we really support here is, with the PCT in particular, is pricing signals. Our architecture is all about introducing over our network, pricing signals.

And that's the key reason, by the way, that we don't believe we need broadband, okay. A key element that we don't believe we need broadband is because we are looking at an architecture where the intelligence is distributed and pushed to the edge of the network.

And what I mean by that is, you have intelligence as we have shown, as we have been demonstrated to. There is intelligence at these, at these devices. So all we have to do as a utility is send a pricing signal, right. The policy of what to do with that pricing signal is all determined by all these smart devices on the end.

So what are the current and future potential HAN applications? Well, load shifting and shaping and load limiting. The next generation of our AC cycling programs. More of the automated demand response. In-home displays. Energy management systems. Plug-in hybrid electric vehicle smart charging. And distributed generation and storage. Control of distributed generation and distributed storage.

So I wanted to just highlight a couple of examples of the benefits of this enhanced communication. What it does for us.

If we look at our Smart AC program today we have got both thermostats and compressor switches that are basically a one-way receiver via the paging network. The PCT does have some Internet accessibility but there is obviously the possibility to disconnect this without notice. So we have limited ability -- Once we put it in we think it's good but we don't know for sure whether or not a customer disables its functionality.

So basically what we are left with is low-impact estimates that are based on statically accurate M&E or M&V studies.

So what do we get with combining two-way communications with the AC cycling program? Well, we suddenly have two-way communications via the meter. Our disconnects are identifiable via interval data. We have real granular data as far as what is happening.

The participation and the load impact is measurable and confirmable. The PCT can also act as the in-home display, as we saw in the demonstration.

And we have the potential here for do-it-yourself installation.

(Whereupon, CPUC Commissioner Chong rejoined the workshop.)

MR. TANG: So what would be some examples to some other emerging technologies that we are looking to leverage with the home area network? I broke them up into basically three categories.

One would be in-home displays and smart appliances. What is the opportunity here? The opportunity for conservation savings is really through information feedback and instantaneous and cumulative cost information.

Comfort controls. We spent a lot of time talking about comfort controls. But nevertheless, it is the ability to adjust temperature, humidity. To react to the weather, to react to historical data. To even do some pre-cooling. Right? Pre-cool a household at three p.m. before we actually really start hitting our critical peak periods.

And another category would be integrated wireless lighting. But basically I was giving a presentation at Google a few weeks ago and I was in what must have been at least a LEED-certified Gold if not Platinum building. And we were in this conference room. There was a lot of natural light. But we still had the lights on because people wanted to be able to take notes.

So I asked to please turn off the lights because it was actually a day that we, PG&E, were running one of our -- we were actually running our CPP program. So this was about a month ago.

And the person went over to turn the light switch off. And interestingly enough, when they turned the light switch off, every single light in the room turned off. So every single light in that room was on one circuit. Why, right? If the builder had enough foresight to think it through and put --

ASSOCIATE MEMBER ROSENFELD: It also violates Title 24. Title 24 requires two light switches. Title 24 requires two light switches in every space.

MR. TANG: They had two switches but those switches controlled one set of lights. So I guess my point was, I would love to have seen, you know, half the room or every other light on one switch and every other light on the other switch. Because they could have had their energy consumption --

ASSOCIATE MEMBER ROSENFELD: Title 24 requires that.

MR. TANG: Okay.

ASSOCIATE MEMBER ROSENFELD: But we agree.

(Laughter)

MR. TANG: A real simple thing, right?

ASSOCIATE MEMBER ROSENFELD: Right.

MR. TANG: But you look at it and you say, okay. So we can try to get ahead of that in the building code but that only addresses permanent retrofits and new construction.

So is there a solution? Is there a way to address this problem? We have actually found a number of companies that are working on kind of integrated, wireless lighting where you actually put something between the light bulb and the socket that the light bulb goes into and you have the ability to actually have more granular control over which lights will actually turn on.

Now this can all be -- In a commercial environment this can all be part of an energy management system.

And that's really it. I just have this slide on peak choice, which is our demand response program. And I guess my only comment on this is that customers like choice.

Our latest demand response program, which the Commission approved, allows us to go in front of our customers and really let them define what is the amount of reduction, what is the commitment level that they are willing to sign up for.

What sort of lead time do they need in order to be able to respond to the event.

What is the maximum number of events that they are willing to participate in.

What's the maximum number of hours that they are willing to participate for each event.

What is the window? So what time of day can an event occur for you and what are the number of consecutive event days that you are willing to stand up for.

So we think that as we continue to think through these demand response programs and load management issues we also have to think about what keeps the customer happy. Otherwise we could have that same situation as we did back in 2001 where we inadvertently lose customers' willingness to participate in this program because it becomes too inflexible. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Andrew, before you -- I have two quick questions. Hopefully quick questions. On your emerging technologies. What do you see the utility role being in promoting those technologies?

MR. TANG: We have, we have -- We are funded to do both a demand response program -- cost-effective innovative demand response programs and cost-effective energy-efficiency programs. So we have mechanisms in place where we actually bring these opportunities to our customers and show them as opportunities for them to reduce their energy bills or conserve energy.

PRESIDING MEMBER PFANNENSTIEL: So you are facilitating between the manufacturer or the retailer and the customer?

MR. TANG: Yes.

PRESIDING MEMBER PFANNENSTIEL: And then -- You don't have to go back to the slide. But earlier on you were talking about your expected megawatts on demand response programs. And I think you said 1.3 gigawatts, something like that.

MR. TANG: By 2011.

PRESIDING MEMBER PFANNENSTIEL: By 2011.

Is that both load control programs and price responsive programs?

MR. TANG: That is, yes.

ASSOCIATE MEMBER ROSENFELD: And just one second. Could you convert that to percentage. That's on the total demand of PG&E on a hot day of how much?

MR. TANG: That's a good question. Statewide on a hot day is 50 gigawatts, right. So PG&E --

ASSOCIATE MEMBER ROSENFELD: How much?

PRESIDING MEMBER PFANNENSTIEL: The system is 55.

MR. TANG: Is 55. So PG&E is probably about a third of the statewide load.

PRESIDING MEMBER PFANNENSTIEL: So it's 20 or thereabouts.

ASSOCIATE MEMBER ROSENFELD: Twenty. So it's an eight percent effect, it's a big deal. Yes, go ahead, Jackie.

PRESIDING MEMBER PFANNENSTIEL: Well it is a big deal but it's still a little below, I think, what we had thought back when we set the goals for price responsive programs. I think we thought we would get farther than this by 2011.

So was this a base case estimate? Are you looking at accelerating from there or is this about as much as you think you are going to be able to achieve?

MR. TANG: Well the key issue is cost effectiveness, right?

PRESIDING MEMBER PFANNENSTIEL: Yes, right.

MR. TANG: That's the rub. And can we achieve more, possibly. But would it necessarily be cost-effective? That's the issue. And that's one of the reasons why we actually do look at the smart meter upgrade with a lot of excitement. Because the issue on cost-effectiveness is literally the communications costs or the hardware costs to get at devices.

PRESIDING MEMBER PFANNENSTIEL: Right. But you will have the meters in, right?

MR. TANG: The meter deployment wraps up in 2012.

PRESIDING MEMBER PFANNENSTIEL: So you will have most of them in by 2011. I am just a little surprised that your number is, frankly, as low as it is, given the fact that millions of your customers will have the basic -- lots of metering capability at that point.

So are you looking at new programs that aren't currently on your radar screen for the smaller customers, residential, small commercial, in that time frame? Or are you extrapolating from where you are today?

MR. TANG: So this is the portfolio that we actually, currently have on file that we filed on June 2 with the CPUC. Do we continue to evaluate other programs? Would we look to bring on other programs of other technology or uses of technology evolved? I think the answer is, yes. But as far as what's on the record for what Commissioner Chong is going to hold our feet to the fire on, that is that 1.3 gigawatts of demand response by 2011.

PRESIDING MEMBER PFANNENSTIEL: And how about price responsive programs? Are you assuming that you have some active and well-participated in CPP programs at that point?

MR. TANG: We do, yes.

PRESIDING MEMBER PFANNENSTIEL: Okay, thank you. Other questions?

ASSOCIATE MEMBER ROSENFELD: Yes, I do.

PRESIDING MEMBER PFANNENSTIEL: Art, go

ahead.

ASSOCIATE MEMBER ROSENFELD: A couple of slides back near the end you were talking about the spec. You had a slide about what your system should enable and you talked about two bucks. Of one-way communication adding $6 to the price or something. Are you suggesting that you want changes in the specs for the PCT?

MR. TANG: No. I like the concept of having the flexibility that it's an open port. I guess it's an SDIO port, Ron. I like the concept of the fact that it's an open port so that there is that flexibility. So that if somehow, some way, some reason that the 13 million meter opportunity that the three IOUs have is not big enough you don't strand the entire PCT. You just strand the communications chip. That's part of that expansion port.

ASSOCIATE MEMBER ROSENFELD: I may be complicating my own life here. But you said that the three utilities have pretty much decided they want Zigbee.

MR. TANG: Yes.

ASSOCIATE MEMBER ROSENFELD: Does that very important decision, does that affect your design or the ideal PCT?

MR. TANG: I don't believe so. From my standpoint that is the functional requirements that we go out to the market and say, well we want a PCT that communicates over Zigbee.

ASSOCIATE MEMBER ROSENFELD: So you want it to be Zigbee, you want to depend on Zigbee, but you don't necessarily want to build Zigbee into the PCT to save money?

MR. TANG: No, I do want Zigbee built into the PCT.

ASSOCIATE MEMBER ROSENFELD: You do want it.

MR. TANG: Absolutely.

ASSOCIATE MEMBER ROSENFELD: We would have objection to that.

MR. TANG: I would have no objection to that. I question whether or not we need to have other communications technologies built into, built into it.

ASSOCIATE MEMBER ROSENFELD: We had a conversation last night with the three IOUs and Janet Corey representing PG&E. And we tried to assure her that we, given a few years down the road and everything is working fine with Zigbee or whatever else and no hiccups and so on, we certainly would not expect the one-way backup to have to go on forever. Title 24 gets revised every three years, after all. So we do regard it as a sort of temporary test.

MR. TANG: Yes. My only comment on that is that it adds overhead.

ASSOCIATE MEMBER ROSENFELD: Yes.

MR. TANG: I just think that, you know. I just think that that adds confusion in the marketplace. My opinion.

ASSOCIATE MEMBER ROSENFELD: When this all ends I'd like to gossip with you some more.

MR. TANG: Okay.

ASSOCIATE MEMBER ROSENFELD: Okay.

MR. OLIVA: Good afternoon Commissioners and staff. Thank you for inviting us to speak today. My name is Larry Oliva and I run the demand response programs for Southern California Edison. I, in the interest of time, are not going to go over some of the ground that Andrew went over. We are much aligned on the concepts here with respect to devices in the home and communications technologies and so on.

And what I would like to talk about

today is what we have been have been doing and what we are planning to do with respect to demand response and load control in communications and enabling devices.

I just want to put this up. Everybody loves George Burns. And everybody remembers, even today, commercials that we had back in the 1970s where the theme was, why don't you give your appliances the afternoon off. And the pitch man was George Burns and it actually worked very well. It was before we had time of use rates. It was just an information message and people still remember it.

We do have a strong history in looking at different demand response approaches. We had actually tested and used in a pilot program a meter in 1980 which is similar to the kind of meter that we are going to be installing in AMI today where it is remotely communicating and demand limiting in the meter. And we did a demand response program where we actually limited the demand, the total demand of the customer.

We initiated AC cycling in 1983. We had 91,000 customers on the program by 1985. Today we have 305,000 customers on the program.

We also started large customer programs in the '80s. And as everybody knows, they were used very heavily during the energy crisis.

The key technologies that Edison is working on, looking at developing over the next decade include the information display devices, programmable communicating thermostats, electric vehicles, PHEVs, solar and technologies that enable renewables such as wind.

This is the direction we're heading. We're spending a lot of time and money on all of these things and they are part of our Smart Connect applications as well as our demand response applications and our electric vehicle research.

Our demand response portfolio can be looked at different ways. Today I would like to just present them in a sort of communication, enabling technology way.

On the upper left hand corner is our dispatchable DR resources. So these are basically our AC cycling where it's a one-way communication to air conditioners, ag pumps, water pumping. It works very well. We have about 665 megawatts on those types of programs.

On the upper right are what I all customer-advised demand response. And we have 735 megawatts there. And that includes our interruptible program, capacity bidding, demand bidding, CPP, dynamic pricing, real-time pricing and our aggregator DR contracts. And the difference here is that we are providing the participants a signal. There's a signal that there is an event or there's a signal that there's a price.

And where we want to move both of these types of programs is to the lower boxes where we are taking, getting our dispatch programs and making them more precise. Getting more granularity so that we can dispatch these devices on a circuit-by-circuit basis.

We already do that today. Many of our AC cycling devices can be dispatched on a district or substation basis. But we have different vintages of devices out there so we can't do it uniformly. But we are moving in the direction of doing that.

And then on predictability and amount of demand response. We are moving in the direction of AutoDR in our demand response application filed

June 2. We have put in $4 million for an expanded AutoDR program. We also have $27 million in for our technology assessment technology incentive program, which also is a part of an AutoDR program.

So we are moving in the direction of automating demand response for all the reasons that were talked about this morning.

ASSOCIATE MEMBER ROSENFELD: Sorry. Could you give the two numbers again you gave for AutoDR. I just couldn't hear you.

MR. OLIVA: I'm sorry. Four million dollars for the AutoDR program and $27 million for the TATI program.

A large part of our Smart Connect application is providing customers information. And we will on the website provide lots of information to the customers about their monthly usage, about their costs, about their daily usage. Many things can be provided through that portal.

Another thing that we are going to be providing is information to customers about their usage on the tiered rate structure that we currently have. And I want to talk to you about that a little bit.

We can, with AMI, tell customers where they are with respect to their tier position in the Tiers 1, 2, 3, 4 and 5. A customer can get on the website -- And this is not available today yet but this is just a mock-up of what could be provided.

A customer can go on the website and see, oh gee, today I am in Tier 3. So far in the billing cycle it's 18 days. I've got seven more days on average, based on my usage historically. It's going to take me seven days and I'll be in Tier 4. Then I face different prices in those tiers. So with tier position customers know more about their costs during the month.

So they don't have to wait for their bill. And since we do have hot summers in Southern California many customers run up into Tier 3, 4 and 5 and the Tier 5 costs are pretty significant. And people can look at, you know, how soon they will be in Tier 5 and that will remind them to stay away from Tier 5 if they can.

And then the next version of this would be to provide notifications to customers about what tier they might or the tier that they are entering into. A customer could sign up for a tier notification that says, please provide me an e-mail or a phone call or a text message as to when I am entering Tier 4 or when I am entering Tier 5. And this can easily be done. So we call that tier alert notifications.

And the next iteration of that, as the technology is developed, is we could even have a refrigerator magnet-type device. And we have already talked to a manufacturer about this. That could display via Zigbee communication to this refrigerator magnet, what tier the customer is in at the moment.

So we think this is pretty interesting. And given that we do have a tiered rate structure right now it would encourage energy conservation. And that is a big part of our savings that we are hoping for with AMI.

Now with our load control program. Which I mentioned, 305,000 customers on it over 600 megawatts. We are going to be expanding that program dramatically. We have the cycling devices there now. As we deploy AMI between 2009 and 2012, some customers will be enabled to have a PCT device. But customers without meters won't be enabled. So if they want to be on a load control program we can still install an SDP device, a summer discount plan device or a cycling device.

However, what we would like to do is move away from our cycling devices and encourage customers more to PCTs. So we can, because we are going to be offering a peak-time rebate as our incentive mechanism for participation in these programs, we can change the incentives. In fact lower some incentives for the cycling devices and have higher incentives on the PCTs to encourage customers to go to the PCTs.

Also the PCTs have an override option and they provide customers information on their comfort and so on. So we do think that we will see a migration by customers from the cycling devices to PCTs over time.

Our business case, which we filed with the Commission, has us installing, or customers installing, PCTs. About 500,000 by 2012, devices, PCT devices.

Now on both the summer discount plan cycling device or the PCT the paper performance can work in a variety of ways. You're familiar with the peak-time rebate where a customer if they just lower their usage on a peak-time rebate event day, they will get a rebate. And what we will be filing in our GRC Phase 2 next week is a 75 cent per kilowatt hour rebate just for the load reduction during a peak-time rebate event.

But if they have enabling technology, where we actually dispatch the control. That is, an increase in temperature, say four or six degrees. Then we would pay an additional 75 cents a kilowatt hour. So with enabling technology the customer would earn a rebate of $1.50 per kilowatt hour under that program.

So it would encourage customers to go to PCTs. It would encourage customers to participate in advance. And it would be paper performance so we wouldn't, we would go away from the current program we have today, which is an up-front incentive in the beginning of the summer and then we don't know whether we have events and we don't know exactly who is participating in them. With metering we will know all of that.

Also we are looking at providing customers different options with respect to the settings for automated controls. So that it could be a four degree setback or a six degree setback and it could be for four hours or it could be for six hours. It could be total shutoff. These are things that we are going to be testing with a pilot, a customer behavior pilot, to see if it actually does make a difference to customers when it is giving them these different choices.

The other key initiatives we have. Plug-in hybrid vehicles. We have a partnership with Ford where we are actually working with them on use cases for integrating the PHEVs into the home with respect to demand response and Smart Grid.

You're familiar with the California Solar Initiative. We are working with various manufacturers on integrated home/business energy management systems, in-home displays. A number of devices. We are contacted by vendors and manufacturers all the time about their products.

And we are not looking for partnerships in terms of an investment partnership or participating in the market itself for devices in the home. We are really just trying to tell them, here is the information we're providing. Here is the protocol we're using. We're going to be sending price signals. We may be sending other signals.

And you'll need to -- you know. Here are the interoperability requirements. You know, here's what it is. Take it and use it, please. So the vendors like Control Four, which is software approach that has information on the television screen and tells customers about many things. Their energy usage, their appliances and status in the home. Their investment portfolio, all kinds of stuff the customer can go or a person can go to on their television screen and look at all kinds of things.

But the point is that we are communicating, working with all of these different vendors. We would like to facilitate all solutions to customers that will help encourage conservation and demand response.

We are not interested on the customer side of the meter in terms of investment. We just want to implement programs the best way. We want to make the market work.

So I think that Ms. Pepetone earlier today listed, which I thought in a very nice way and comprehensive way, the utility requirements and customer requirements. They were like functional requirements. And I think we are aligned. I think the three utilities are aligned in complying with all of those six requirements that she laid out.

So I am ready for questions.

PRESIDING MEMBER PFANNENSTIEL: Thank you. The one that I just want to make sure I am understanding this. Right now Edison has two ideas for in-home display. One will be essentially through the Internet on computers, home computers, and the other will be PCTs?

MR. OLIVA: Those are the two that I talked about, yes. But we're talking with a vendor about a USB port-type device that plugs into your computer, communicates with the meter, and then gives you real-time information on usage.

PRESIDING MEMBER PFANNENSTIEL: So there are many other technologies that we would expect the market to develop and to offer and you are working with any number of those.

MR. OLIVA: Exactly.

PRESIDING MEMBER PFANNENSTIEL: But the two that you are actually working on right now are the two you talked about.

MR. OLIVA: We're working on -- right, yes. And on the PCT we have an RFI out. We have not issued an RFP yet. We are actually hoping to -- the Open HAN reference design. We'd like to -- I think earlier it was mentioned that in a few weeks or months that that would be finalized. That would be very helpful for our RFP.

PRESIDING MEMBER PFANNENSTIEL: Because your idea is to migrate the air conditioning cycling customers on to PCTs.

MR. OLIVA: That's correct.

PRESIDING MEMBER PFANNENSTIEL: Great. Thank you. Other questions? Anything else?

ASSOCIATE MEMBER ROSENFELD: Yes. You mentioned warning the customer that he or she is within seven days of entering Tier 4 or whatever.

MR. OLIVA: Yes.

ASSOCIATE MEMBER ROSENFELD: At the same time, I presume, you also will offer to the customer what his or her real-time price is, time of use price on a regular afternoon and CPP price.

MR. OLIVA: Well if they had a CPP rate that would be available also. Under this concept it would be that the customer is on a tiered rate design. So if they are on that rate then we are showing the customer what the price is for each tier. And how long they are going to be in that tier before they reach the next one.

ASSOCIATE MEMBER ROSENFELD: You know, it's just that we have to learn, and the customer is going to have to learn once we get onto critical peak pricing, that there are two considerations. So I'm sort of visualizing a world in which you go up to the screen to find out how you're doing and it says, which of two things do you want to know. One is the tier issue.

MR. OLIVA: Right.

ASSOCIATE MEMBER ROSENFELD: And the other is, what am I using right now. And am I -- And if you have peak-time rebate, am I complying with my -- Am I below the peak-time rebate requirement.

MR. OLIVA: Right. It's what we call a customer reference service level or something, something like that. But the baseline is what you're talking about.

PRESIDING MEMBER PFANNENSTIEL: If there is a time-varying rate of some ilk that the customer would be eligible for, perhaps you could also show what the customer's bill would be if that customer had chosen that rate.

MR. OLIVA: That's absolutely correct.

And as we get experienced where the customer has usage data over a period of time. Say they have a year. They have had the meter for a year. They have the usage data hourly for a year.

And they can see. We can show them a comparison. If you were on CPP here is what your bills would have been. If you were on TOU, you know. And it could be comparing their performance on peak-time rebate compared to CPP. Many things are possible. The data enables lots of, lots of ideas.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Anything else? Very good, thanks.

MR. OLIVA: Thank you.

MR. D'LIMA: Good afternoon. I want to start up by thanking the Commission, the Commission staff and everyone out here and listening herein on this workshop. We are delighted to participate and we feel it's an honor to be part of this working group.

Let me start out by telling you what I do. I am in the emerging technologies group and we look at, I specifically look at demand response and emerging technologies. I manage that program. We have others that do the energy efficiency programs as well.

And in our scope of activities we basically look at technologies that are near-term to future. So some things that would be in a lab environment all the way into where it's almost marketable. It's commercially available and we are trying to distinguish as to how to introduce them into our programs.

The type of technologies that we look at are quite diverse. Our methods are basically evaluations and demonstrations. So we take technologies that are available, the research organization or the vendor would come in with their technology and they display it to us and we see the value in it. Then we actually do demonstrations at customer sites. We try not to do lab-type demonstrations because that doesn't really give us a whole lot. So we anticipate customer site demonstrations.

So what I am going to do is I am going to describe some of the technologies that we have used in the past in our programs. These have been successfully done in our programs. Some of them have proven out. Some of them have been eliminated on account of costs and budgets.

And then I will go into the technologies that we are looking at presently and then what we are looking at in the future. Some of them will apply to home area networks in a big way and others will also be applicable to commercial/ industrial facilities.

Starting off with the enabling technologies that we have used. We had the smart thermostat program. And I think somebody alluded to it earlier about getting some data on that program. It was basically a one-way paging system. Sorry, it was a two-way paging system in which an MDU, which is a module that was installed in the attic space of a home, and then would send a signal downstream to a thermostat.

It was hard-wired. It was quite expensive because of the two-way paging capabilities. At its peak we had around 4,000 customers. It is no longer in operation on account of costs.

The Summer Saver program is presently in operation. It's one-way paging system in which a page is sent, or can be sent, to a module of the DCU unit. Which is mounted on the air conditioner on the outside of the building, outside of the facility.

So while the Carrier system was two-way and was only for residential, the Summer Saver AC cycling program, Comverge program, is really for residential and commercial, small commercial.

The control unit basically shuts off the compressor. That's what its function is. And it goes through that cycling mode. Customers can enroll in different cycling methodologies. There will be 50 percent cycling or 100 percent cycling and then they get certain incentives on account of that. That's for the residential.

For the commercial it's 30 and 50 percent cycling.

In talking to the Comverge company they have indicated that they have around 28,000 -- I think about 34,000 customers so far with around, they're claiming about 50 percent. Fifty megawatts of load reduction, of capability.

Okay, let me get into the on-line energy tool that we have. Which applies to any customer that has an ADR meter and that would be enrolled in a demand response program. So those are the two requirements.

And the reason for an ADR meter is

because that information can be uploaded into our system and they can see it the next day and various things.

They have capabilities to do comparisons, they have capabilities to do trending. Actually discriminations between different facilities that they own in the same area. They can group facilities and then do discrimination analysis from those. But this is an on-line tool so you basically have to get an on-line log-in and access it.

It also is our means of implementing demand response presently. So a customer that's enrolled in demand response, we would have that information loaded up in here so that -- and ask them how they wanted to be notified.

Accordingly this would send out the e-mail, pager, cell phone, telephone, text message, whatever you want to do. And we have different flavors of that so they can accordingly get this notification that a demand response event is going to occur or will be occurring the next day.

And then the final one that I wanted to talk about really doesn't have demand response access or activity right now but we're looking for it in the future. It would be the permanent load shifting. This is a program that was recently approved.

So we have got two different technologies on there with a total of around three and a third megawatts thermal mass of freezer space. So this is basically pre-cooling the freezer space and then letting it ride through a critical peak in our system. So it's shifting it on a permanent basis but it is basically a pre-cooling capability.

(Whereupon, CPUC Commissioner Chong and CPUC Advisor Campbell exited the meeting room.)

MR. D'LIMA: And then the last one is gas absorption AC systems, or engine-driven AC systems. Which is not really geared towards demand response at this time.

All right. So now this is where we are at in terms of what we are doing right now. We are looking, and this is one of the several technologies we are looking at. And actually I wanted to spend more time on what we are looking at in the near-term and future. So I will just go over this very briefly.

This is hotel room or a hospitality energy control. As we know we have seen classrooms, we have seen various facilities having motion sensors and light activation methods to either turn on lighting and turn it off when there's nothing in the room. But very few have penetrated the hospitality industry. We are trying to see what it would take to get this kind of technology into that particular customer base.

So we are doing a present study and evaluation of three different hotels. We have taken up I think about ten rooms in each hotel and we have outfitted them with control systems. These are stand-alone, islanded control systems. But in the future, after this initial study is done as to how interaction would occur and whether the particular hospitality or that particular hotel sees benefits from it. Then we could go to the next step where we actually try to inject demand response signals into these hotel rooms.

ASSOCIATE MEMBER ROSENFELD: Could I ask you?

MR. D'LIMA: Sure.

ASSOCIATE MEMBER ROSENFELD: In most of the world this trick is done with key cards. That is, in China or Japan or Europe, everything is off until you put your door card, your key card in. And we were actually experimenting with some of hotels in Sacramento. Why didn't you just go the key card route?

MR. D'LIMA: Well, we thought of that. We went to the, to the hotels that we were targeting and their response was, well, that's pretty easy to override. Everyone gets two key cards when they walk in, are issued two key cards. You put one in the slot and you forget it.

ASSOCIATE MEMBER ROSENFELD: Or just your business card will work also.

(Laughter)

MR. D'LIMA: I don't know about that.

ASSOCIATE MEMBER ROSENFELD: Oh yeah, sure.

MR. D'LIMA: Okay. So you put the card in. A credit card maybe. And it would stay on. Basically you get no benefit from it. And so they were preferring that we try something that was different in order to get energy savings.

ASSOCIATE MEMBER ROSENFELD: No, that's very interesting, you answered my question. I would like to stay in touch with you because we were thinking of using the key card trick for Title 24, next edition. And so if you think that's a serious problem, that it is too easy to override. We should stay in touch. Thank you.

MR. D'LIMA: Yes. That's what the industry has told us. That they have seen this. And actually I have got to admit I did this when I was outside of the country.

ADVISOR TUTT: And I would also add that what I have experienced is that the hotel hospitality staff has blank cards that they stick in there to clean the rooms and they leave them behind all the time.

MR. D'LIMA: Okay. All right.

So this is what we are doing right now. One of the technologies we are demonstrating, there are others. We are doing something in lighting as well.

Now I want to talk about home area networks. And these are, these are plans that we have on the drawing board right now for actual projects that we are going to start rolling out in the next few months to the next few years. Some of these require the technology to be constructed. It may not exist there right now. Like a home energy manager or a home energy EMS, a management system.

While we know that they do exist in a very rudimentary form we are thinking about more like the ones that you have in commercial/ industrial buildings where you can identify specific appliances, specific nodes that you want to control. That's not there yet. And so that's going to be further down the line. That is our wish list for future demonstrations.

But what we are looking at is some of these appliances that have some controls in them. We have been in discussions with some of the major appliance manufacturers and they told us that, you know, unless you show us some value. Show us some value. Not the utilities, us some value. We are not willing to even put in an extra bolt in our appliance. An extra nut in our appliance. So it has been a hard sell for them. We see the consumer pushing it more than the utility trying to force them in that direction.

All of this we anticipate doing through our electric meter. So while our roll-out plans are to 2011, we will be piloting or actually doing some pilot studies of our AMI over the next few months. After that initial evaluation is done on AMI, our smart meter system, then we will start looking at doing this kind of work. We'll be using different types of home area network technologies and then trying to connect through our smart meter.

One thing. An integrated appliance and non-appliance integrated controller. So as I mentioned, we have appliances that would have integrated controllers and then we have other non-appliances. Meaning like lighting, maybe a TV or something like that, which would not have a controller in it and that we could turn off or control somehow.

There are plug-in controllers that you can buy today. That you plug into the wall and you plug your appliance into it. Those are very hard controllers. Meaning in the sense that they can cause some damage, possibly if it's frequented a lot in the future. Because it basically hard-shuts off your appliance. So if your particular refrigerator, for instance, is running through its cooling mode and is making ice and you shut it off that way it could cause some damage. You'll have a big block of ice somewhere to deal with.

And the last one is we are looking at doing some testing on wireless and PLC protocols. So we look at home area networks using a combination. And I think one of the gentlemen before me stated that too. That we don't see one, single protocol existing in the home. We see multiple protocols. In fact, there may be already existing wireless or wired home area networks existing in the -- do I need to leave? Existing in the home. And the question would be, how do we leverage all of those. And I will go into a little bit of detail next.

So these are the kinds of technologies that we are focusing on. Programmable communicating thermostats are very big on the list, very high up on the list. Simple controllers and sensors and energy management devices. Smart controllers. And of course energy storage. With the, with the plan that the PV and the PHEV will one day be a possible energy storage device.

Se we have heard a lot of discussions about PCTs. For the most part we agree with them. We want PCTs to have basic functionality and have the control capability that will be compatible with our infrastructure. In that case it would need to be two-way, standards-based communications. That way we can control it, we can get direct feedback from the PCT.

And one thing. We do not really see the PCT being the -- How do I want to put this? The big plasma TV type of thing. We see the PCT as having a role in the home but not where the customer is basically focusing all their time.

So we envision that there will be other display devices. Whether they be the TV, whether it be another computer, whether it be your in-home display or it would be your cell phone. We see that being an alternative means of getting information to the customer. The PCT will be one very important -- will play a very important role there but it will not be the only role, the only place that you would get messaging sent to.

All right. So this is a basic diagram of our energy management scheme. So what we see is customers, once they have this capability -- And we are talking to different vendors of technologies that already exist in the home like companies that make gaming technology, companies that are making computer application technologies, automation technologies.

We would like to use that means of however they're deploying it to put on top of that some sort of an application-based, energy management system. So that it's not a separate device and not a separate box that goes into the home. We see it as being an integrated part of a bigger concept that the homeowner wants.

So what we see here is basically the utility signals would come two-way into the home, out of the home. But that would not be the way that the consumer will get access to their utility information. Meaning that they would get information from the meter, but that's about all that they would go to. They could not access our AMI system by any means.

The way that they could get access to their information remotely would be through the Internet, would be through other processes in the home or whatever they set up as their capabilities to enable that to happen. Whether it be some sort of a telephone line or it would be something else. We do not see them using our AMI system to get access to their information.

We see them using our meter to get

access to their meter data and that's it. If they want to get day-old meter information they can go on-line to our system and they can access it there too. But that would not mean direct access through our AMI. That's very secure, that's very limiting. We had some problems trying to have customers on demand trying to get meter reads through our system.

Okay, let's go to the next one. So now here is a scenario in which there are companies out there that provide energy services that basically will put in all of these smart devices in your home and then come to the utility and say, okay, we can offer this capability because now this customer has enrolled in our smart home concept.

They are primarily doing this out from the vantage of having security in the home or providing some sort of entertainment or some sort of other service to the home. But they have in addition to that some capability to do energy management. Those are important, I think, alliances that we want to maintain because that way we can leverage what other companies are doing for the consumer and we can benefit from it.

Once again, the access is through the Internet, it is not through our AMI system. What we have here is a secure, customer interface. Whether it resides on a router or resides on a -- gosh, what's the word I'm thinking. Anyway, it resides on another device in the home.

It will control smart loads. So these are, these are not necessarily loads that are -- These are not -- These are loads that can be programmed inside the home. They do not necessarily have to go outside to get programming information. And they don't necessarily need another device like an energy manager to tell them when to turn off or to set certain rules.

Energy managers would be things that you set rules. You tell it, at so-and-so price you turn off this. At this other price you turn off something else. This on the other hand would say, this particular appliance you turn off at this particular price and above. So that's the smart part of it that this simple connection would entail.

And then we get into the concept of energy storage. We know that there's a big push towards energy -- actually a big push towards zero energy homes by 2020. And so we want to start working on that right now to enable that to happen by that date if not earlier.

So in that respect we are presently working with a vendor to install a large battery in a, in a commercial site. This is about a 100 kilowatt battery. It's only a part of that particular commercial site load. What the plan is, to initially look at just seeing how the battery performs. So for the next nine to 12 months we'd be looking at battery performance.

Subsequent to that we will then be looking at how we can take that same battery and try to get demand response. And maybe even battery to grid opportunities. But that's, you know, assuming that a lot of things happen by that date. Meaning, the rates are such that it enables that to happen. So that there is no penalty to the customer to enable this.

Also we need to make sure that the technology is capable of doing that without blowing up a whole bunch of things inside the customer home.

What I am showing here is really a depiction of what could happen in terms of how load can be shifted to off-peak periods. Sorry, can be -- Actually, the battery can be discharged at particular periods.

And I think that's my conclusions. We know that technologies need stimulation. This is not going to happen without some sort of stimulus, either through monetary means, through rate design, through Title 24. There has to be some sort of stimulus that these vendors are looking at. They are not going to put them -- They are not going to make this change. Maybe the customers will stimulate the market. But that's assuming a lot.

We encourage technology diversity. And by that I mean not just a protocol diversity but also the different ideas on achieving the same goal. We don't think that just one type of technology is going to work for every customer. We think that there will be other technologies that will do the same thing, provide the same benefit, as the other.

I think you have already heard my spiel on PCTs.

And then we presently are proposing a residential appliance controls and automation technology program. One of the problems that we face in emerging technologies is that while we can commercial facilities and we can look at, you know, 50 demonstrations at commercial sites, we cannot, we really don't have the budget to do large scale demonstrations. And by this I mean hundreds of facilities. And so we propose to the Utilities Commission that we get funding to enable us to do something like this for the residential side.

And then the last thing is, of course, goals and standards. It's important that we have some of these technologies eventually migrate to goals and standards. Because we see that being the stimulus. That's it.

PRESIDING MEMBER PFANNENSTIEL: Thank you very much. I think because we are running late we are probably not going to hold the panel in-panel longer even though we may have other cross-cutting questions.

I think what we'll do now is move into public comment. I think we have others here who have expressed a desire to have an opportunity to address us. And the hour is late so Gabe, unless you or David have something else I think we should move into the Public and Industry Comment section.

MR. G. TAYLOR: That's correct.

PRESIDING MEMBER PFANNENSTIEL: Do you have -- Did you gather cards or will we just invite participants to come up?

MR. G. TAYLOR: I have three cards and I have, I believe, four speakers who contacted me ahead of time and asked to speak.

PRESIDING MEMBER PFANNENSTIEL: All right. All right, we'll do that. And we will ask people to be respectful of other people's time and the hour and limit your remarks to us. With that, who is first?

MR. G. TAYLOR: Since there is no volunteer I would like just jump right in and call people. Is that okay?

PRESIDING MEMBER PFANNENSTIEL: Please.

MR. G. TAYLOR: We have a representative, I believe from Cassatt Corporation. Cassatt, I apologize. And I have spoken to all of these presenters ahead of time and they have assured me approximately five minutes.

MR. OESTREICH: Thanks again. I'm Ken Oestreich with Cassatt Corporation. What I want to do, actually, is shift gears just a little bit. It seemed like the day was really highly weighted toward residential demand response.

And looking at some of the statistics that the Demand Response Research Center had, and others had today, there's actually a lot of opportunity in the commercial and industrial space. And I think the DRRC guys said, there's a lot of participation. I think 51 percent megawatts or something, I forget the number, from industrial but very little from commercial.

And what I want to address is an opportunity we see in commercial that's untapped and kind of dive into that. Okay.

So some of you might have seen this graph. This is from the Department of Energy. And it depicts what the energy consumption of data centers in commercial space have been. These are these huge, very dense energy consumers that are essentially on all the time. These are not things that have been traditionally thought of as open to demand response programs.

So I just want to, rather than talk about specific technologies, talk about some opportunities for technology to apply toward. So this graph shows there's been about an estimated 60 gigawatts of energy that goes toward these data centers. It's expected to climb. The Department of Energy has shown what some of the opportunities are to reduce this, even through demand response or through voluntary curtailment.

The reason the problem has been really huge is that these computers in these data centers are on all the time. So it's the moral equivalent of keeping the lights on in the house all the time. And when they're busy they use only marginally more power than when they are not. So when they are not busy they're just chewing up power.

And no one is looking at either voluntary curtailment during these periods of idleness when the blue lines are essentially idle, curtailing the use of these computers during these periods. Or during a DR event saying, which of these computers are actually less important than others.

What we are proposing, and I am not going to go through all the technology, is that there are policy-based approaches. And I think I heard some folks talk about the economics of signaling price and using policy to determine curtailment based on price.

Knowing something about these computers, what's running on them, what's important, the moral equivalent of knowing who is in the room and not turning the lights off in that room if somebody is there. The equivalent is if you know the computers are busy don't turn them off, but if they are not busy, turn them off. And being independent of the software and the vendors and the technologies. This has to be compatible with what's out there today, so vendor neutrality.

And the concept is really, really simple, right. You have a data center full of high, medium, low priority computers. And let me just give you the sense of magnitude here by the way. These data centers are tens of thousands of square feet and we're talking megawatts. We're not talking a couple of PCs on desks but we're talking rooms five times the size of this one.

And should you get an event you can perhaps peel back, say for the PG&E programs, a minimum of 15 percent or perhaps more based on the bidding process or the requirements of the program. And when the event is over restore these computers to their state.

Now the reason this hasn't been done is there's been this myth that you can't turn computers off the way you can turn lights off or HVAC off or whatever. And what we want to do in this forum of emerging technologies is say, there's the ability to do that now. So I am here to kind of heighten your awareness about this, I suppose. That there's this huge opportunity.

The way, kind of schematically, this works is there's forms of controllers here that talk to the computers. And they listen for things. They listen for DRAS servers from the DRC and from the utilities. They can listen to the clock, they can listen to essentially any input, even price signaling. The react to policy and they control these energy-consuming devices.

We happen to market one of these. There's other companies that do the same thing. But what I just wanted to take the forum of five minutes for was to say, there isn't specific incentive or even -- incentive for the utilities or awareness here, particularly from the amount of residential conversation we've had today, around this huge opportunity of 60 gigawatts.

Granted, not all of it can be reduced. But even if a few percentage of it can be reduced, even just in California, it seems like a big, untapped opportunity for the forum here. So thank you.

PRESIDING MEMBER PFANNENSTIEL: Well let me just ask this. When we suggest, and of course this body does not set rates. But when we suggest the possibility of critical peak pricing rates in this commercial segment of the population we hear really wild screams because they say, part of the commercial segment is --

The commercial sector has to do with customers coming into their buildings all the time and they say there's very little room to respond and the other half is office buildings, or another part is office buildings with computers. And they say, we can't shut down the computers.

So somehow there's a chicken and egg problem. And who is going to put the rates out there first and who is going to market the devices to show that they, in fact, can reduce their computer usage.

MR. OESTREICH: And that's one of the myths we are trying to get over. Which is -- The truth there are some of these. A percentage, not an entirety, that can be reduced voluntarily during periods. So we're doing our best. And I hope through the forum here we can at least begin to change the behavior.

PRESIDING MEMBER PFANNENSTIEL: That's very good to know. Thank you for coming in and sharing this with us.

MR. OESTREICH: Thank you.

MR. G. TAYLOR: We started off with a very good example. Thank you very much, Ken.

Do we have Eco-Factor here? I'm just going down the list. This is purely random order.

MR. STEINBERG: Thank you. My name is John Steinberg, I am here for Eco-Factor. And Ron Hofmann spoke earlier in the morning about how the transition from analog technology to digital technology has enabled a bunch of new capabilities. And we think really what that's about is about the transition from hardware, sort of hardwired hardware capabilities, to having capabilities in software. And the advantage of having the capabilities in software is flexibility.

And Mike Gravely spoke this morning

about how one size fits all demand response really didn't work. And we think that's exactly the kind of place that demonstrates the flexibility of software because software gives you the capability of doing demand response on a customized, individual house, individual day basis.

And so what software will let you do is, using just a two-way communicating thermostat, and this would be the reference PCT design or the thermostats that Tim Simon will be telling you about shortly I guess. Using just that minimal hardware and putting the software and the algorithms on a centralized server. The software will enable you to do individualized integrated demand side management on a house by house, day by day basis.

So the way this works. And I should say that we are leveraging work that was PIER-sponsored, done at the Center for the Built Environment at the University of California Berkeley by David Auslander and others.

With this system you can reduce HVAC cycling by up to 40 percent without sacrificing comfort, give consumers complete control and let them choose how to optimize for their preferences.

And again, consumers retain control over everything about how it's used because, again, it's software, it's customizable. It delivers both energy efficiency and demand response advantages over hardware-only systems. So the way this would work is, again --

ASSOCIATE MEMBER ROSENFELD: Hold on, I just didn't understand. What do you mean when you say, reduces cycling by 40 percent. I just didn't follow.

MR. STEINBERG: The software system, if time permits I'll get more into this in another slide or so here. But essentially what the software does is monitors on a minute-by-minute basis the on and off behavior of the air conditioner or in the winter context of the furnace.

And by optimizing the programming, by running various algorithms that can reduce energy consumption without sacrificing comfort, we have actually found in the field that we can do, if you add up all the various algorithms that were running, that you can actually reduce the number of minutes in a day that the HVAC system is running by 40 percent.

Does that answer the question?

ASSOCIATE MEMBER ROSENFELD: So you reduce the HVAC load by 40 percent.

MR. STEINBERG: Yes.

ASSOCIATE MEMBER ROSENFELD: Okay.

MR. STEINBERG: Yes sir. So essentially the way this works is, any two-way communicating device. And data is sent from the thermostat to the central server essentially using the thermostat as a sensor, recording various kinds of data in the house. And then recommendations are sent back from the server to the thermostat.

And the consumer will be able to choose either to ignore the recommendation, to manually accept the recommendation, or to implement the recommendations automatically. Express general preferences that the server then optimizes and implements sort of on a minute-by-minute basis. And at any point, as with the PCT reference design, this can obviously be overridden by the consumer.

So essentially the way this works is, again, our server -- The server in a system like this would be logging data on a minute-by-minute basis. Not just from the individual thermostats but from a number of other sources, including outside weather information and the like.

And by analyzing that data, is able to determine what we're calling the dynamic signature of each individual house. Which essentially means, how much energy, how long with the HVAC system have to run to raise the temperature in a house by a certain amount. And how long it will take for that energy to dissipate once the HVAC system is turned off. And that varies from house to house, from day to day.

And once you determine that dynamic signature that then allows you to do prediction, not just a few minutes ahead but as far as day-ahead of what the HVAC cycling behavior will be, what the temperatures inside the house will be and what the energy consumption inside the house will be.

And so there are a number of benefits both on the consumer side and back to the grid. On the consumer side what software like this will allow is for consumers to understand why their bills are as high as they are.

You can think of your energy bill for running the HVAC system as sort of a composite of three components. There's the cost that's associated with how well or poorly insulated your house is.

There's costs associated with how efficient your HVAC system is.

And then there's costs associated with your behavior in the form of the setback schedule, or lack thereof, and of the manual overrides that you're doing on an ongoing basis.

And with a server-based software system like this it's possible to identify and separate and quantify how each of those three components interact and determine the bill. So three different consumers could have the same $500 a month energy bill but Consumer A it's high because of terrible insulation. Consumer B is because it's a defective air conditioner. And Consumer C because they have terrible programming. A system like this can distinguish between those three different kinds of reasons for that bill.

On the grid side of things a system like this, as I mentioned, can do hourly forecasting up to a day ahead to understand what the loads will look like for the houses under management with a system like this. It can help improve penetration of a demand response system into the residential marketplace because now there are benefits for the consumers.

There is an energy efficiency aspect to it. A system like this will allow intelligent customized pre-cooling. Which means that the impact on the homeowners can be significantly reduced of actually running a demand response event in that house.

It allows real-time demand response verification because minute-by-minute data is coming back from the thermostat to the server. So it will be known if the house is not heating up as it should be during a demand response event.

And a system like this also can produce different kinds of demand response benefits. The reliability demand response is the most common today. It can easily optimize for time of use, real-time pricing, critical peak pricing, by shifting loads based upon the varying prices. And because of the fast response of something like the PCT it can help with spinning reserve as well.

And this is something that's working today. There have been successful field trials both in the northern and southern hemispheres.

The savings aspect, the load shifting and the forecasting have all been verified.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Let me point out that those who are coming up at the end of the day, short presentations for some very big ideas. And so I really encourage people to send us something in writing. This whets our appetite for reading it and we will read it and we will review it. But clearly don't feel like your five minutes is the whole time we are going to devote to this. We really want to hear more about it. So thank you.

MR. STEINBERG: Okay, thank you.

MR. TOCA: Commissioners and staff, thanks for giving us a chance to go over some more detail. I wanted to enter into the record a case study of a project we're working on with bulk energy storage and show how it can enable demand response, perhaps where it wasn't available before. I won't go through the entire slide. I just want to hit the high points of the bulk storage project. I am working with Mike Gravely on this and there's some other work we're doing as well.

This situation we have is a

semiconductor manufacturer down in Southern California Edison territory. They have a 7.5 megawatt peak load pretty much 24/7.

Power quality is an important issue for them. As a result they have a 33 kilovolt dedicated line from the Edison substation. It's an eight mile line. In an attempt to get good power quality.

This facility cannot provide demand response because of their production.

However, they are interrupted so they do drop load non-voluntarily. They have seven to nine significant power quality events a year. Typically in an industry like this the scrap and the down time is worth about $500,000 per hour.

They just had an interruption this last month on a Friday afternoon, they were down for two hours. Apparently a bird landed on two wires and caused a short circuit. So it was a pretty bad situation for them.

Back in 2000 they installed emergency generation. Rental generators cost them $1.6 million in order to cover this need.

This particular manufacturer also has a corporate priority to be green, environmentally sensitive and to reduce greenhouse gas emissions. So that's their situation.

Our solution is to install a five megawatt energy storage system. That's not on the screen here. It talks about the particular technology. But it's a five megawatt system with eight hours of storage, which would be a 40 megawatt hour system for this facility.

The benefit to the host is, right off the bat they receive an uninterruptible power supply and emergency backup. This also improves their power quality at the system.

This allows them to not rely on their diesel generation and have uninterrupted service.

The environmental and social benefits related to this are, of course, no diesel BUG, renewable energy integration.

One of the ways that the battery will pay for itself is by providing frequency regulation services, ancillary services to CAISO from behind the customer meter. This will be done without exporting power to the grid but simply by modulating the amount of power that this customer will receive. And of course CAISO needs this service in order to integrate wind energy coming up in the next couple of years.

This will be allowed under the MRTU Release 1A, about this time, hopefully next year.

So the cost of the system will be subsidized for the customer by providing ancillary services and, of course, by demand response incentives.

So now you have got a situation where an industrial load could not provide demand response and now they can provide five megawatts of response. And since it is controlled electronically, all these other infrastructure issues, electronic issues and means of controlling the demand, can be applied for this system.

This is an aerial view of the plant we're working with. You can tell in the upper left hand corner they've got an open space there. If you look really close you can see the pad where the ten megawatt -- excuse me. Yes, it's ten megawatts of diesel generation that was installed to get them through the rolling blackouts. The energy storage device will go right in that spot.

I would just point out there are no incentives currently for energy storage so this project has to be entirely economically based upon the direct benefit to the customer, ancillary service sales to CAISO and the tariff provisions for demand response in the current retail tariffs for Edison.

There may be additional opportunities in terms of support to the grid. Right now Edison is very happy for us to put this there because it removes a -- it cleans up five megawatts of customer load that otherwise might cause problems on the grid. But they haven't yet talked about ways to support that. Thank you.

ASSOCIATE MEMBER ROSENFELD: Could I ask you a question?

MR. TOCA: Yes.

ASSOCIATE MEMBER ROSENFELD: You provide regulation to the ISO or a spinning reserve or something. Can you actually do frequency regulation?

MR. TOCA: Yes. Of course the battery can respond very quickly.

ASSOCIATE MEMBER ROSENFELD: Yes.

MR. TOCA: That will be our intention. When the CAISO requires regulation down to reduce power on the grid -- Let me keep it straight. Regulation down will pull power from the grid by charging the battery, five megawatts to the battery. That will increase the demand at the Edison meter from 7.5 to 12.5 megawatts.

And then when CAISO needs regulation up, power put back on to the grid, we will discharge the battery. And that will reduce the draw at the Edison meter from 7.5 megawatts to 2.5 megawatts. So that way there's no power exported onto the grid but CAISO still gets the result of a 5 megawatt pulse, both up and down.

ASSOCIATE MEMBER ROSENFELD: Good.

MR. TOCA: Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you.

MR. G. TAYLOR: Next up we have Corporate Systems Engineering.

MR. S. TAYLOR: Good afternoon. My name is Steve Taylor, I am the President of Corporate Systems Engineering. And I have a lot of information that I won't provide so rest assured I'm only going to give you bullets right now and everything else will be followed up in writing.

The main reason you care about, what I think at this point, is that I have spent 27 years deploying systems just like what you are contemplating now. And there are some bullet items that you really need to seriously consider.

The first one is the topic of price response versus grid reliability. Let's say we actually have full deployment of these smart thermostats. PCTs as we're talking about. What happens if the ISO changes the price from 15 cents to a buck and a half? They're all going to turn off, right? That's what they're supposed to do.

Let's say you actually survive that event. Four hours later it goes from a buck and a half to 15 cents. What's going to happen now? They're all going to come back on. The technology isn't the problem. The rulemaking about how you control them is.

So if you look at it from the ISO's perspective, what do they have? They're pushing a string. It's price. That's all they've got. They can't go from $1.50 to $1.40 to $1.30 to ramp this load back in. You need hard, direct load control capabilities.

So that having been said, once you have the technology in place, what can you do with it? Balances for renewables. What if the solar panel says to the other electrical deferrable devices in the house, I am not generating electricity right now, and the water heater automatically shuts off. You don't have to have gas peaking over here to offset your solar and to offset your wind.

Not only does that give you better efficiency, no-carbon credits, et cetera. But you have the ability to respond automatically. So you can put more renewables on your system now than you could before. Because you automatically have the offset for them. So if you are going to incentivize them to put a solar panel on the roof, incentivize them to put a switch on the water heater, or the pool pump, or the air conditioner to offset it and save us the carbon credits.

Which brings me to the next point. If you really want this to work, how do you actually monetize properly the value of that load. And that's really the problem. If we had trading rules at the ISO so that a unit of energy was a unit of energy, no matter where it came from. We had fair, equitable, transparent treatment. You would have people coming to the table providing this technology, providing these programs.

So how do you do that? Well, the real question is, is electricity an entitlement? I own a home. I've paid my bills all these years. Should I have that energy? And if I do, should I not be able to sell it at the prevailing rate right now? And if as a customer I am not large enough should I not be able to band together and sell my power at the same rate someone else can?

So how do you arrive at that true price? Locational marginal pricing, capacity payments, transmission distribution expenses being offset.

What about line loss? You would have had to generate 110 or 120 units to get down there where they're using 100. So if I shut it off shouldn't I get paid for 120, not 100? So how do you get that true value? And I'll follow up in writing on all those points. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you very much. Art, a question.

ASSOCIATE MEMBER ROSENFELD: I would like to make one small point. This is the overshoot business. The ISO drops the price from over $1 back to 15 cents.

MR. S. TAYLOR: Right.

ASSOCIATE MEMBER ROSENFELD: The PCTs do have a random delay of up to half an hour before something comes back on. And as I remember on the statewide pilot project, which was a few thousand houses.

MR. S. TAYLOR: Right.

ASSOCIATE MEMBER ROSENFELD: To our happy surprise, there was no overshoot visible at all. It just wasn't a problem.

MR. S. TAYLOR: That is not actually the point I'm trying to make. Because we have been able to do that with the technology that's out there now. I have about two million endpoints about, a little shy of four gigawatts under control nationwide in some of these major programs, two of which were discussed here today, here in California.

The problem is you have economic benefit. I discussed this with John Glidden at the ISO. These tools could be used as ramping tools. We're talking about increased economic efficiency in operation of the grid. This is true money that you can point to. How do we get that in the hands of the people who want to participate?

All that we are talking about here is economically viable, it's technologically feasible. It's here today. We just don't have the rules to cash in on it properly. And we're waiting on the power companies in-between to find rate structures to implement programs.

We know we can put load out there under control very, very quickly. We're demonstrating it in Los Angeles right now. So it is not just the overshoot, it's all of these items. And I won't drone on about it today. I'll give you a list in writing.

ASSOCIATE MEMBER ROSENFELD: All right.

PRESIDING MEMBER PFANNENSTIEL: Thank you.

MR. G. TAYLOR: Next up we have ICE Energy.

MR. WEINGARTEN: Thank you very much. My name is Irwin Weingarten. I have been tasked by ICE Energy to come and open the Northern California office for ICE Energy.

We have been very fortunate. We are going to be receiving -- We received a contract from PG&E to install a sizable amount of ICE storage air conditioning. And so today --

ASSOCIATE MEMBER ROSENFELD: Can you get a little closer to your mic.

MR. WEINGARTEN: Oh, I'm sorry.

ASSOCIATE MEMBER ROSENFELD: Thank you.

MR. WEINGARTEN: Is that better?

ASSOCIATE MEMBER ROSENFELD: Yes.

MR. WEINGARTEN: Good. So today I'd like to discuss permanent load shifting for load management.

Just a bit of history. We know that DR funds for PLS to reduce peak load is reasonable.

And in the first quarter of '08 we received PLS contracts for storage both in Northern California and in Southern California. In Northern California it's administered through Trane and Cypress. Down in Southern California it's through Honeywell.

When both of these programs are fully subscribed to we anticipate 140,000 megawatt hours of load shifting over the course of the 20-year life period for our ice storage air conditioning.

This is a table that comes directly from the CEC staff report. And it shows in the climate zones almost a 50 percent reduction in cooling energy using ice storage air conditioning. But what's more important is the 95 percent reductio in building cooling during the period peaks of on-peak noon to six.

The chart basically speaks for itself.

ASSOCIATE MEMBER ROSENFELD: I'm sorry to be slow with the figures but how many 40,000 megawatt hours? But over 20 years.

MR. WEINGARTEN: Yes.

ASSOCIATE MEMBER ROSENFELD: So to get some idea of what it is annually I have to divide by 20?

MR. WEINGARTEN: Correct.

ASSOCIATE MEMBER ROSENFELD: Thank you.

MR. WEINGARTEN: Now the problem is most buildings have poor load factor. And there's really not much we can do with buildings that have poor load factors because most of them are operating between eight and six.

The preferred method would be, of course, to shift the load. And TOU rates will help do that. However, TOU rates will not help with cooling comfort, as you already indicated, in many of the commercial buildings. Because they must have cooling comfort. They can't curtail there.

Our ICE Energy changes the load profile substantially and its advantage is to lower off-peak rates. And how is that done? This is a simple example of one of our systems in Victorville. Victorville has made a citywide adoption of our units for many of its city-owned facilities. The police department, fire department, city hall, et cetera.

So by shifting the load of our ice storage air conditioning, producing the air conditioning in the evening when the rates are lower, the ambient temperature is lower, our units work better, the remaining DX units -- the existing HVAC units are not working in 110 degree ambient. We remove the peak load and have the load transferred off-peak.

We have just developed with this our CoolData Smart Grid Controller. This controller mentions a lot of the aspects that you were discussing today. It can control schedule, dispatch, measurement and verification.

It is Smart Grid ready.

It has network communications with many of the platforms that have been mentioned today.

It can be locally scheduled and remotely dispatched.

Direct load control for demand response of other building assets that can be tied into our

Smart Data controller.

This is what our unit looked like in the first generation. The storage medium was on the left, the generating compressor was on the right.

And now this is our new unit. Our new unit is a fully integrated unit which is sized smaller than the previous unit and contains all the components that are listed here, including the Smart Data controller.

Now we know that the CEC in your handout, the number two items end use storage systems to store energy during off-peak periods. This is a wonderful solution that I think should be adopted. Thank you for your time.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Wait a minute.

ASSOCIATE MEMBER ROSENFELD: I guess I have a question.

PRESIDING MEMBER PFANNENSTIEL: Go ahead.

ASSOCIATE MEMBER ROSENFELD: Ice storage, or water storage or thermal storage is a great idea. But what is it that it needs to turn it back into a big success? Is it tariffs? Is it stability of tariffs? I'm not quite clear. It sounds a little bit like you're bashing your way through an open door.

(Laughter)

MR. WEINGARTEN: I don't like that example. Please define the question a little bit.

ASSOCIATE MEMBER ROSENFELD: It's such a good idea it should pay without any, without you having to see us particularly.

PRESIDING MEMBER PFANNENSTIEL: Yes, what is the role of regulators in helping this technology?

ASSOCIATE MEMBER ROSENFELD: Yes, what am I supposed to do, except applaud?

(Laughter and applause)

MR. WEINGARTEN: We feel -- Well first of all, the demonstration programs at PG&E and Southern California Edison are certainly a good start. But this could certainly be used as a utility resource. And not just individually to the individual business owners. I know it is not in the utility model for their business structure but this certainly can be considered a utility resource.

PRESIDING MEMBER PFANNENSTIEL: Right. So you should talk to the utilities about using it as a utility resource. I think Art and I agree that it sounds like it is a terrific technology.

MR. WEINGARTEN: Yes.

PRESIDING MEMBER PFANNENSTIEL: We've watched it being used and we support it. But we're just, and I share his confusion about the appropriate role of government in the market that should be out there for your technology.

MR. WEINGARTEN: All right. We'll prepare a written comment to that and address it.

PRESIDING MEMBER PFANNENSTIEL: I appreciate it.

MR. WEINGARTEN: Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you.

ASSOCIATE MEMBER ROSENFELD: Thank you.

MR. WANG: Thank you Commissioners for affording us the opportunity to explain a little bit more about how some of the demonstrations -- the demonstration you saw a little bit earlier. My name is Jackson Wang with e-Radio USA, Inc.

ASSOCIATE MEMBER ROSENFELD: I didn't catch your last name, Jackson.

MR. WANG: Wang, it's W-A-N-G.

ASSOCIATE MEMBER ROSENFELD: Thank you.

MR. WANG: We have been working with FM technology -- Personally I have been working with FM technology since the early '90s. So it is very, very satisfying to see that through the years it has been evaluated for a number of uses.

We work in the automotive industry as well. And just like the home system, the automobile will also have -- you draw a bubble around a vehicle and there are a number of communication technologies that can penetrate in and out. In the automotive industry they chose the FM technology as almost a ubiquitous way of communicating. Certainly in the infotainment arena. You cannot buy a vehicle today, pretty much -- very, very difficult to buy a car without an FM radio.

So in the context for demand response we feel that the existing infrastructure, which cost billions of dollars to build. And we were able to leverage that infrastructure to deliver a very low-cost way of performing to demand response.

The standard is a global standard. You can pretty much to go to any continent in the world and deploy this technology. As you can see, it's effectively able to communicate with programmable, communicating thermostats.

There are very, very few areas in North America that you cannot reach with an FM signal. I could show you some coverage maps. They look like big concentric circles. Certainly in the state of California.

We have also worked on technology so that we could deliver the message -- the signal. Not only in a secure manner but it also is targeted. In fact we could even target, as alluded to earlier, within a zip code or even a street by street.

And I mentioned the automotive industry. The RDS-specific technology has been installed through some of the clients that we have worked with over the last decade or so and there are well over 20 million vehicles deployed.

So we feel that RDS or FM enables a consumer to be able to participate in a smart program, almost naming the tune in the fewest notes. And we could deploy a system in a new market in a matter of weeks rather than months or years.

The RDS technology receiver. The technology is very, very mature. Therefore the cost is very,

very low. We are able to manufacture or assemble some of these units for literally several dollars.

One of the characteristics is because it's one way. There is no way for someone else to be able to access the information that's private. Again if you draw a bubble around, whether it's a vehicle or a home, if the air only goes in but doesn't come out, obviously there is no information. Having said that, it is also compatible with very, very sophisticated networks, both in the car and in the home.

And lastly, I'm sure Tim Simon is going t be describing some of the -- the thermostat that can be installed by the consumer and they have done so for a number of years.

Here is a simplified architecture drawing of what is it that we do. So in our operations center at e-Radio we have a number of sockets. And Clay Collier earlier made a presentation on some of the -- on the utility side. Interestingly enough, Clay and I worked on the intelligent transportation systems a number of years ago. In fact, we co-authored a number of papers in the early '90s.

The arrows that connect to our

operations center, these are independent but complementary data. For example, we do work with centers like NOAA and other weather centers. So if there are warnings -- And more importantly, you can have predictive information. At the home you normally would get what the outside temperature is already. But if there's a cold front moving in you might have a different cooling strategy than if you didn't have -- It's kind of like when you play a game of Tetris. You could have a fair score and you can see what blocks are coming down.

So we have a ubiquitous coverage through our radio partners and we are able to also communicate in the event of a blackout through something like a satellite communication network, which does not depend on terrestrial lines.

On the receiver side we are working with a number of automotive manufacturers, as we have done in the telematics field. And a number of them now have plug-in electric hybrid vehicles. So since the FM technology is already embedded in we feel that there is an opportunity to take advantage of that. At absolutely no additional hardware costs the information can come in and be used for demand response.

We are also in conversation with a number of appliance makers. Because of the coverage along with the low cost for the receiver chip set a number of appliance makers have expressed interest in trying this technology out as well. And that's all I have for today.

PRESIDING MEMBER PFANNENSTIEL: Thank you.

MR. G. TAYLOR: Tim Simon. If anybody else would like to make a public comment at this time please see me and I'll give you a blue card to fill out.

MR. SIMON: If you don't mind I'll sit here because I have a couple of products. Well partly because it's late and partly because most people have said most of the things I was going to say, I'll be very brief.

ASSOCIATE MEMBER ROSENFELD: You should identify yourself.

MR. SIMON: I won't read most of this book I brought with me.

PRESIDING MEMBER PFANNENSTIEL: Mr. Simon, identify yourself for the record, please.

MR. SIMON: My name is Tim Simon, Golden

Power Manufacturing, Hong Kong.

Earlier somebody, and I forgot which of the panel asked the question about Home Depot and the PCT. I forgot who asked that. But the question was, where do they stand. Home Depot had orders placed for us to ship this product to them in October of 2008, which would be a few months from now.

When the Title 24 issue came up as to questionability they pulled that and delayed it. And not because it had been delayed but because there is a question as to what was going on. If the statement had been, California is abandoning the Title 24 PCT the product would be on the shelf in October.

But because there was a question of, what will the Title 24 say and will it change and be in conflict with the product, the decision was made, we had to then say, we can't go forward with that. We are coming up with a similar product, which will be on the shelf probably in January, which will meet what we think Title 24 is or was and so forth.

In our world as a thermostat manufacturer, and while we make other products a good part of our business is thermostats. And we make them for a number of different customers. We never have our name on the product but we make them for Home Depot, for some of their competitors, for people in the HVAC business and so on and so on. We have 11 major customers that carry the product with their name on it.

We look at it slightly differently, though. We look at it that our product would prosper even if Title 24 and the whole concept of utilities and smart thermostats was totally abandoned and banned from history and could never continue. We use the product as an interface for a lot of other uses inside the home besides just energy management.

And the way we do that is our product uses modules like this which plug into the thermostat. We currently have a Zigbee module, which the utilities have embraced, a Z-Wave module, which the consumer electronics industry has embraced for a lot of consumer products. A WiFi module to be ready in a few weeks. And the RDS module, which e-Radio has demonstrated. And we have a 6LOWPAN module. So we give the customer the ability to use those modules by themselves or in tandem with each other. For example --

ASSOCIATE MEMBER ROSENFELD: In tandem means you could have both RDS and Zigbee installed at the same time?

MR. SIMON: Yes, you could have four modules installed at one time in one thermostat.

So in theory the utility could send out a command over Zigbee or over e-Radio saying there's an event, I want you to change your HVAC system and raise the target temperature. The thermostat seeing that, the customer could easily program it to say, when that happens also turn off my pool pump.

If the price of electricity gets over X number of cents a kilowatt hour, turn off my pool pump or my ice machine or something else. Which the consumer would choose how that was. That's his choice to build that into it. So it could have a Z-Wave signal that would go out to those devices or a Zigbee signal or whatever. So it could come in under one format and continue through it. So the thermostat becomes a gateway as well as a display.

And rather than go through what we've said before. You saw the demonstration that they had earlier. We do that. So we have that with our e-Radio module. Which e-Radio had ready to demonstrate but I don't want to take the time now, obviously.

So from our standpoint, the question was asked earlier, why is someone here addressing you, what do we hope to gain? I could tell you all about what we do and say that's nice.

But at the end of it what I would say is, the best thing you can do to help us is to come up with a definition for a Title 24 or something similar. Or make the statement, we're out of that business, let the marketplace decide. And if you make that statement, let the marketplace decide, our products will be on the shelf very quickly doing exactly what I think you want them to do right now, along the way you have already described them.

But if we had this gray area that goes back and forth and we don't know if your decision is going to be different than what we thought it was and therefore we have to hold the product off because we may be in conflict with some future decision, it makes it difficult for us.

ASSOCIATE MEMBER ROSENFELD: Understood.

MR. SIMON: So just in closing we'll say some of what we do. One of the things that we do is we make a good, better, best scenario. So we have thermostats which we'll call CT. Communicating thermostat, not programmable. Because even though I've made millions and millions and millions of programmable thermostats I don't believe in them. I think that time is an outmoded way to do it. We believe in occupancy sensing and other ways of knowing. So we have a low-end thermostat at around the $59 range. It does everything you want but it's not programmable.

Then we have a mid-range that you have always talked about. The $99 retail range.

And then the higher-end one with the large display, which is about $159. So we're looking at filling all those different needs.

We also have the idea of taking the thermostat off the wall. We think it should be on the bed stand or near the TV or somewhere else and that's one of the things that we do. So I kept it short. Any other questions?

PRESIDING MEMBER PFANNENSTIEL: No. Thank you very much.

ASSOCIATE MEMBER ROSENFELD: Yes. Just a trivial point. You said you can very easily tell it at a certain price, not only raise the temperature four degrees but also turn off the pool pump.

MR. SIMON: Correct.

ASSOCIATE MEMBER ROSENFELD: Is that programmability built into that little device?

MR. SIMON: Yes, it's built into there. And the thermostat -- This is what one of my -- One of the previous speakers said, this is like the postal system. This is the mailbox. It accepts anything. It could be a FedEx package, a UPS package, post office, whatever.

It has the ability to be programmed by the consumer or by the maker of a specific product. In other words, a pool pump manufacturer might sell their pool pump and include with it one of these modules. And say, when you plug this module into that thermostat that you have it will then be able to communicate, number one. It will have the programming information displayed on the screen, number two.

And it will send information from the pool pump. It will tell the thermostat, I am using more current than I usually do so maybe I'm clogged, maybe I'm getting old. Maybe there's some other problem so you might want to go look at it. Or if it was a sump pump it would say, today I am operating more often than I normally do. And that software lives on this module. So when you buy that product it is going to communicate with this thermostat when you plug that module in. It then updates itself instantly.

ASSOCIATE MEMBER ROSENFELD: So two last questions. So you could accept quite a few of these modules.

MR. SIMON: Absolutely. And we even have an expansion port for those people that say no, no, no, I need more than that.

ASSOCIATE MEMBER ROSENFELD: And the other trivial point is, from where I can see now I don't see any keypad or how I can talk to the damn thing.

MR. SIMON: Two things happen. One is that we have a WiFi module, so you suddenly have your computer.

ASSOCIATE MEMBER ROSENFELD: Okay.

MR. SIMON: The other is we have an Ethernet module so you suddenly have your computer.

The last is, because it's a fairly large touch screen you have the ability of displaying a keypad on it to allow you to do that if you feel comfortable doing that.

ASSOCIATE MEMBER ROSENFELD: Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you. Is that it, Gabe?

MR. G. TAYLOR: We have one more public commenter, Ed Cazalet from MegaWatt Storage Farms.

MR. CAZALET: I'm Ed Cazalet, MegaWatt Storage Farms. Just a very brief comment and I have come here to ask for nothing.

We are intending to install large quantities of batteries on the wholesale grid for preforming demand response activities, interacting mainly with the ISO markets. And so these -- The technologies we're using is proven technology from Japan and it comes in two megawatt boxes. And you can put hundreds to gigawatts worth of batteries on the grid to solve a variety of problems, including the renewables integration as we put thousands of megawatts of wind on the grid.

The only challenge with this technology is we would like to move it closer to the load to achieve additional benefits. And because of the way the retail rates work you are limited in how far you can push it close to the load. In Japan you'll see this technology, ten megawatts, sitting at a plant like Hitachi on the grid, in addition to having 50 megawatts at a wind farm.

So it would be very nice to be able to have retail rates that would allow us to fully utilize this technology. Thank you.

PRESIDING MEMBER PFANNENSTIEL: Thank you. That's it, Mr. Taylor?

MR. G. TAYLOR: Yes, thank you so much.

PRESIDING MEMBER PFANNENSTIEL: I'm exhausted. A very meaty day, as I think we knew going in. I do encourage written comments to focus our attention on the points that are most important for us in coming away from this with some proposed load management standards.

But we really want to thank all of you, and those who were here who have since left, for making this a really, very useful workshop. And if there is nothing further we will be adjourned.

(Whereupon, at 5:28 p.m., the Committee Workshop was adjourned.)

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CERTIFICATE OF REPORTER

I, JOHN COTA, an Electronic Reporter, do hereby certify that I am a disinterested person herein; that I recorded the foregoing California Energy Committee Workshop; that it was thereafter transcribed into typewriting.

I further certify that I am not of counsel or attorney for any of the parties to said workshop, nor in any way interested in outcome of said workshop.

IN WITNESS WHEREOF, I have hereunto set my hand this 7th day of July, 2008.