

**Power Association of Northern California  
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Keynote Address by California Public Utilities Commissioner  
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*“Is Our Electric Grid Smarter Than a Fifth Grader?”*

This is the name of my talk this morning: “Is our electric grid smarter than a fifth grader?”

Federal Developments

Well, it’s exciting times in the energy world indeed. Our federal government has decided that our electric grid may NOT be smarter than a fifth grader and should be modernized. And it is what we ladies would call a “total Susan Boyle makeover.” One aspect of this modernization is being called “smart grid” development.

Everybody has a slightly different Smart Grid definition and that’s a problem in itself, but today, I’ll use the FERC’s definition. The FERC defines Smart Grid to mean applying digital technologies to the grid, and enabling real-time coordination of information from generation supply resources, demand resources and distributed energy resources, like fuel cells, solar, combined heat and power, microturbines and energy storage,

In 2007, Congress boldly declared in the Energy Independence Act (EISA) that modernizing the grid is national policy. EISA requires FERC, once sufficient consensus has been achieved through a process managed by the National Institute of Standards and Technology (NIST), to adopt standards and protocols necessary to ensure Smart Grid functionality and interoperability in the interstate transmission of electric power and in regional and wholesale markets.

The smart grid policy was prompted by a sense of urgency in the industry and government for the development of smart grid standards and the deployment of smart grid technologies. FERC is going to focus on some key interoperability standards on an accelerated timeframe, with NIST’s help.

Finally FERC is also seeking to provide an interim rate policy under which jurisdictional public utilities may seek to cover costs of Smart Grid deployments before standards are adopted through a rulemaking. It recognizes that a key issue for utilities in deciding whether to invest in Smart Grid technologies may involve the potential for stranded costs associated with legacy systems that are replaced by smart grid equipment. It strikes me that state utility commissions similarly may need to develop interim rate policies to accommodate costs of smart grid deployments in areas where the states have traditional jurisdiction.

So as we stand here today, on the brink of undertaking the modernization of the electric grid, it reminds me of the telecommunications industry just before the Eighties. Up to then, all we had was a plain old black telephone run on a circuit switched network. But innovators envisioned something bold: competition and phones without wires. The Federal Communications Commission embraced both visions and what happened? Tremendous innovation was released in the space, and the transformational Internet came along. Those circuit switched networks are now upgrading to become Internet Protocol packet switched networks.

Like the phone system of the Eighties, I see the electric grid as being on the verge of a significant transformation. It's a historic moment. We can envision clearly some of the tremendous benefits a smarter grid can bring – reliability, efficiency, self healing, wide area situational awareness, enhanced security - but we can't possibly know where this journey will end once we unleash the entrepreneurs. When we started work on the telephone network, we thought we might get competition and wireless phones. We have in our pockets now devices that are so much more than phones: they have more computing power than what NASA used to send a man to the moon. They are phones, web browsers, PDAs, video and music players, GPS devices, and more.

As to Smart Grid, the nation just got Willie Wonka's golden ticket to help fund it, with the \$4.5 billion available for Smart Grid initiatives in the American Recovery and Reinvestment Act, delivered compliments of your clean green energy President, Barack Obama. The Department of Energy will be administering this funding. Notices of funding availability have already gone out about how the DOE plans to dole out the money, with comments due May 6th. There are some problems with their early plans, at least in my view. For example, the \$20 million limit on one of the grant programs is a glaring problem.

This smart grid federal funding as a once-in-a-lifetime opportunity for California. To secure funding for the state, our utilities and other companies should collaborate and put forward innovative and comprehensive demonstration projects that advance knowledge about smart grid issues. The PUC has held a smart grid workshop and a symposium to put a spotlight on this issue and encourage our utilities to apply for DOE funding.

The Smart Grid developments are exciting to me, because California's cutting edge energy policies are asking the electric grid to do things it wasn't designed to do. Let me offer a few examples:

First, the electric grid was built to deliver power one way from large power plants located far from energy users to users. However, today, the drive toward more renewable energy and reduced greenhouse gas emissions is leading to a rapid expansion of distributed energy, like solar and combined heat and power. These energy sources are located on, or near, consumers' premises. This presents a new set of challenges to the grid. How much energy is being produced? When? Where? Which way is the power flowing?

Second, while the grid has historically consisted of power generators and power users, now we are beginning to see devices that are both generators and users -- for example, energy storage and plug in electric vehicles.

Third, energy consumers are beginning to participate more actively as they seek ways to reduce the environmental impacts of their energy use and save money. Energy efficiency and demand response are increasing rapidly, as consumers buy into green issues and want more information and energy saving tools.

To address these challenges head on -- while maintaining the level of reliability that a high tech society requires, we must together commit to modernizing the electric grid. I understand that this month, the Secretaries of Energy and Commerce will call together some of the top leaders of the electric industry and other stakeholders to call for commitment from the top CEOs for the modernization effort. This national leadership is unusual.

How do we modernize the grid? This is a complex undertaking involving every aspect of the industry, from generation, to transmission, to distribution, and finally to the customer interface. We will see sensors, communications technologies, and intelligence that will help the grid sense what is happening to the energy flows, keep it in balance, and proactively prevent outages. We will need communications and other standards so new technologies can be easily plugged in and integrated. Cybersecurity must be built in for enhanced security.

As an analogy, I am reminded of the effort to develop the USB, the cooperative vendor standard effort by Compaq, DEC, IBM, Intel, Microsoft, and others to support higher transfer speeds to Plug-n-Play peripherals like disks, CD ROMs and tape drives. By accelerating the important standards work, it will help jump start the smart grid by giving vendors and utilities more certainty for products that meet these consensus standards.

### What's Been Done Already

At the California PUC we initiated a Smart Grid rulemaking in December 2008. The Commission's goal in this proceeding is to set broad Smart Grid policy and establish a regulatory framework that can encourage and guide the development of a Smart Grid in California. We are still at an early stage in the proceeding, but I would like to highlight several regulatory issues.

For starters, the California PUC, the California Energy Commission, and the California ISO have been putting in place the foundations of a Smart Grid for several years—decades in some case.

Most significant are the three large investor-owned utilities advanced metering projects. By 2012, every electricity consumer of the three big utilities will have smart meters. These smart meters will give consumers detailed information about how they use energy and will enable new technologies that can automate customers' responses.

We are pioneers in developing dynamic pricing rates for all customers, to go hand in hand with the new advanced meters. We have also put in place demand response programs to try and shave demand on the handful of really hot days when we hit peak. Policies such as decoupling, energy efficiency programs, and building and appliance standards are also important foundations for a Smart Grid.

Finally, markets will play a central role in linking energy producers and users in a smarter grid. The California ISO's recently launched market redesign is good example.

### Guiding Utility Investments

Modernizing the electric grid will likely entail investments by utilities in their distribution systems. As you know, authorizing utilities to invest in their distribution systems is one of the traditional roles of the PUC. Our California utilities are big, and they spend a lot of money each year. For example, in 2007, the Commission approved a \$2.9 billion revenue requirement for PG&E's electric distribution business.

The utilities are already beginning to incorporate smarter infrastructure into their investment plans. PG&E has been investing in substation automation. Southern California Edison has installed systems called "Synchronized Phasor Measurement Systems" on its transmission grid. These systems enable Edison to see where action must be taken to avoid blackouts. In the future, these systems may be able to anticipate problems and automatically isolate certain parts of the grid to keep outages contained.

A third example is San Diego Gas & Electric's "microgrid" pilot project. The microgrid concept is to develop systems that tie together distributed generation, such as fuel cells, energy storage and end-use demand, in a limited portion of the grid. In an emergency, a microgrid could disconnect from the rest of the grid and continue providing reliable service, to critical facilities like hospitals or fire stations.

The PUC will need to determine how to guide utility investments to modernize the electric grid in a way that supports state energy policies and benefits consumers. If things move swiftly due to federal developments, we may need to consider some of this outside the GRC timeframe. As always, we will need to carefully study the costs and consumer benefits.

### Standards to Promote Innovation

While the utilities will clearly have a central role in Smart Grid, most of the technological advancements will occur elsewhere. There are already dozens of technology companies, big and small, developing Smart Grid products and services. We will need their ideas and innovations to succeed in modernizing the grid.

An important aspect of this innovation is to encourage widely accepted standards that promote interoperability between devices and the smart grid. For example, standards

could allow a consumer anywhere in the country can buy a programmable communicating thermostat or smart appliance that can immediately receive pricing information from a utility and respond during peak events.

A Smart Grid has the potential to improve reliability and make the grid more resilient in the face of outages and other problems. However, the introduction of communications to the grid can also create security vulnerabilities. If poorly designed, a disgruntled employee or teenage hacker could break into the system and cause serious harm. For that reason a Smart Grid requires effective and multi-layered cybersecurity built in from the start. I applaud these efforts and expect California to pay special attention to federal efforts in this area.

### Dynamic Pricing

The Smart Grid is not all about technology. It's also about engaging consumers. One of the principal ways the PUC intends to achieve this is through dynamic pricing.

“Dynamic pricing” refers to retail electric rates that reflect actual wholesale market conditions. One example is critical peak pricing, or CPP, which is a rate that includes a short term rate increase during critical conditions. Another example is real time pricing — a rate linked to actual hourly wholesale energy prices.

Dynamic pricing is good for consumers and good for the environment.

On the consumer side, dynamic pricing can lower costs and improve reliability. Currently, on a hot day when the electric system is strained, Flex Your Power puts out FlexAlerts and the California ISO calls on consumers to voluntarily cut their usage. These voluntary appeals are helpful to shave demand. However, dynamic pricing gives a customer an even stronger motivation to respond. If a consumer can lower his or her usage during a critical peak period by, say, turning off unnecessary lights or using less air conditioning, the consumer will save money. With energy costs trending upwards due to increasing fuel and other costs, customers are going to want to save money with dynamic pricing.

In terms of the environment, dynamic pricing will help cut greenhouse gas emissions. In California, when wholesale energy prices are high, the most inefficient and polluting power plants are operating. Dynamic pricing can discourage consumers from using power at peak times, and thus utilities won't have to fire up those less efficient power plants. Also, if the state's wind turbines are spinning at full speed, a customer on dynamic pricing could see low prices, letting them know that it's a good time to run their equipment. This helps keep the system in balance.

Last July, the Commission directed PG&E to propose default critical peak pricing for all large commercial and industrial customers that will go into effect in 2010. PG&E was also required to propose default CPP for small and medium commercial and industrial customers that will go into effect in 2011. PG&E's specific rate proposals are currently

before the Commission. The decision also required PG&E to propose an optional real-time pricing rate for all customer classes that would be available in 2011.

Now is the time for PG&E to put in place dynamic pricing rates because PG&E is rolling out new Smart Meters to all of its customers. PG&E expects to finish deployment of its Smart Meters by 2012. Dynamic pricing will enable consumers to get significant value from their new meters.

In addition to the Smart Meters, it will be exciting to see how dynamic pricing unleashes technological innovation. There are already technologies in the market place or on the cusp that will enable customers to automate their responses to dynamic pricing. These technologies include things like programmable communicating thermostats for residential customers and energy management systems for commercial and industrial customers. Putting in place dynamic pricing rates will give manufacturers an incentive to introduce their products -- and consumers a reason to buy them.

We have firm evidence that customers will, in fact, take advantage of dynamic pricing. Through the end of 2008, PG&E had installed and activated about 188,000 advanced meters, primarily in the Bakersfield region. PG&E offered its residential and small commercial customers the opportunity to sign up for PG&E's new critical peak pricing program, known as SmartRate. PG&E's goal was to sign up six thousand customers, but ten thousand signed up. A recent evaluation found that customers on SmartRate reduced their usage by an average of 17 percent on the nine critical peak days in 2008. That's substantial.

PG&E's program is also open to low income customers that are on the CARE rate. The evaluation found that CARE customers signed up at a higher rate than non-CARE customers. Furthermore, the low-income customers that enrolled managed to cut their usage during peak periods by 11%. This is evidence that when offered dynamic pricing rates, all kinds of customers will take the opportunity to save money.

Despite the strong evidence that residential customers want to take advantage of dynamic pricing, legal barriers are preventing further expansion of dynamic pricing. Current law includes a rate freeze, requires baseline rates and dictates an "increasing block rate structure". The state legislature is currently considering bills that would continue the rate freeze and explicitly prohibit default dynamic pricing for residential customers. While these laws may have been well intentioned at the time, they are now in the way of more sensible rates for residential customers. California is not going to have a Smart Grid if we have dumb electric rates.

### Electric Vehicles

The final area I wanted to discuss is that the smart grid should be designed with the ability to accommodate plug-in electric vehicles.

I am interested in electrification of the transportation sector because 28% of the U.S. greenhouse gas emissions come from the transportation sector. In California, transportation represents 38% of total greenhouse gas emissions. The higher percentage in California is primarily because we have a relatively clean electricity sector.

According to a study conducted by EPRI and NRDC, plug-in hybrid electric vehicles could result in annual greenhouse gas reductions of 100 to 300 million metric tons of CO<sub>2</sub> per year in 2030. At the high end, the EPRI study predicts plug-in hybrids could represent 50% of new vehicle sales in 2030 and 40% of all on-road vehicles.

Due to energy security concerns, President Obama has called for bringing one million plug-in hybrid electric vehicles on the road by 2015.

To make this a reality, we must prepare the smart grid for this plug in hybrid electric vehicle load. How can we maintain the reliability of the electric system if we have a million plugged-in electric cars drawing electricity off the system at different hours of the day? How do we provide incentives for vehicles to charge during off peak hours? Is it a simple price signal or something more?

California entrepreneurs have ideas too. For example, Better Place says commoditize the electric vehicle battery so that drivers can change it out in minutes at battery stations like we currently stop to gas up at gas stations around the country.

FERC has said that it intends for the smart grid to accommodate a wide array of advanced options for EV interaction with the grid. It has encouraged NIST to focus on the development of standards, or extensions of current standards, to provide at least the minimum communications and interoperability requirements that are necessary to permit distribution utilities to facilitate vehicle charging during off peak load periods. Upgrades to dated communications systems between EVs and the grid need to occur.

Finally, does the presence of these plugged in EVs represent a potential resource for energy during critical peak hours? If a consumer does not need to use the electric vehicle during peak and can easily communicate that to the utility, can it be agreed between the consumer and the utility to use the battery in the car as a potential energy source during critical peak periods?

The issues are fascinating and exciting. I wonder if anyone knows any really smart fifth graders who can help? If so, have them text me. Thank you for having me.