

Testimony of Edward Lu
Advanced Projects Program Manager, Google, Inc.
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Hearing on Smart Grid
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Mr. Chairman and members of the Committee, my name is Edward Lu and I am pleased to share my perspective on how to advance the deployment of smart grid technology. I serve as a Program Manager in Advanced Projects at Google. I lead a number of energy-related projects including one that is developing an energy information software tool that will enable consumers to make informed choices about their energy use as they browse the web, read email, or use a mobile phone.

Prior to my position with Google, I served as a NASA astronaut for twelve years. I had the privilege of flying two Space Shuttle missions, a Russian Soyuz mission, and a six-month tour on-board the International Space Station. I am an electrical engineer and have a Ph.D. in applied physics.

Google's mission is to organize the world's information and make it universally accessible and useful. We believe that access to information about personal energy consumption is critical to helping consumers save electricity and money, but unlocking this data requires upgrading the electricity grid to make it smarter. We are tackling this informational challenge on several fronts including developing consumer tools, investing in energy technology companies, and advocating for policies that advance a smarter grid.

The United States can build a "smart grid" and bring our 1950s-era electricity infrastructure into the digital age. The main point that I will make today is that we need to develop this grid in a way that spurs innovation, drives competition, and supplies maximum information to consumers.

- First, we must develop and deploy smart grid technology in a manner that empowers consumers with greater information, tools and choices about how they use electricity, including access to real-time energy information.
- Second, energy information should be made available based on open non-proprietary standards to spur the development of products and services to help consumers save energy and money.

I will also briefly describe a free software product that Google is developing to enable people to get better information about their home electricity consumption.

I. Information helps consumers save energy and money

The way Americans currently buy electricity is like shopping for groceries every day but not getting the bill until the end of the month. How can a family keep to a budget or make smart

choices? When it comes to electricity, how many consumers know how much electricity their house uses, what appliances cost the most to run, or how to go about saving energy or money?

Studies show that when consumers can see in real time how much energy they are using, they save 5 to 15 percent on their electricity use with simple behavioral changes, and even more with investments in energy efficiency. The average U.S. residential customer spends about \$1,200 a year on electricity, so savings simply based on a real-time feedback monitor could amount to \$60 to \$180 per year. In fact, if just half of American households cut their demand by 10 percent, the CO2 emissions avoided would be equal to taking approximately eight million cars off the road.

As a first step to establishing a smart grid, homes must be equipped with advanced energy meters called "smart meters" that identify detailed real-time energy consumption information. With the help of state public utility commissions, utilities throughout the United States are working to replace 40 million old-style electric meters with digital smart meters that can be automatically read throughout the day. Congress also recently included a provision in the American Recovery and Reinvestment Act to speed the installation of smart meters and other smart grid technology. Google applauds these efforts, and encourages utilities, transmission operators, technology companies, and public utility commissions to continue to modernize our electricity infrastructure with the support of Congress.

The benefits of energy information can be enhanced when combined with programmable appliances and dynamic energy pricing. A study conducted by the Department of Energy's Pacific Northwest National Laboratory (PNNL) gave customers access to energy consumption information, broken down by appliance, every fifteen minutes and allowed them to program their water heaters and thermostats to respond to changes in electricity prices. Participants in the PNNL study received cash when they operated their household loads in collaboration with the needs of the grid by reducing their energy usage at times of peak energy demand. Over the year of the study, peak load on the grid was reduced by approximately 15 percent and consumers saved approximately 10 percent on their electricity bills over the previous year. Based on these results, the authors determined that if all customers nationwide engaged in reducing peak loads, peak electricity prices would be substantially reduced and approximately \$70 billion in new generation, transmission, and distribution systems could be avoided, with the savings passed along to ratepayers.

II. Consumers should have access to real-time energy information

Google believes consumers should have access to real-time information about their home electricity use. This means that consumers should know how much energy they are paying for at the time of use. Personal energy information belongs to consumers and they should control who has access to it. Policymakers should provide clarity on ownership of data as the smart grid is built out.

To access energy information in greater detail, homes must be equipped with smart meters or consumer-installed energy monitoring devices. Smart meters are a key part of the smart grid and will enable utilities to provide better service and a more robust electricity delivery system, in addition to enabling consumer access to information. However, installing smart meters does not automatically mean that consumers will receive real-time information about their electricity

usage. While there are some limitations today on the ability of utilities to provide real-time data to consumers, we believe that there are substantial benefits to doing so. Utilities should be encouraged to provide consumers with real-time access to their energy information.

III. Open standards spur innovation and drive competition

In order to achieve the greatest potential for energy savings, consumers should receive information as part of an open ecosystem of hardware and software for energy monitoring, home automation, and device control. For that to happen, the consumer-facing data from the smart meter needs to be available to the consumer in an open non-proprietary format as well as in real time.

Truly open standards would allow consumers to share their data with third parties in a format that is standardized, freely published, and unencumbered by a patent or proprietary claim. The goal is to foster a thriving ecosystem of partners where third-parties will develop and provide products to help consumers decrease and manage their energy demand and save money. For example, a utility or a third-party could offer a service that analyzes a household's electricity usage data, identifies inefficient appliances or practices in the home, and offers tips on how to reduce energy or provides special discounts on efficient appliances or electronic equipment.

The Texas legislature and Public Utility Commission have taken a thoughtful approach to these issues and provides a useful example of a consumer-friendly energy information policy:

- Smart meters must be capable of providing consumers with direct, near real-time access to electricity usage data.
- That data must be stored on the meter in a form that complies with nationally-recognized non-proprietary standards.
- Smart meters must also be capable of communicating with other devices on the premises, such as monitoring devices, load control devices, and prepayment systems.
- Consumers own their energy usage data.
- As smart meters are deployed in Texas, consumers will not have to pay an additional fee or have to obtain special permission to view their data.

IV. We're developing a software tool called Google PowerMeter

Over the last year, our engineers have developed a simple and secure software tool called Google PowerMeter. This will give consumers a means to draw data from their utility or from devices they install themselves to see their own home electricity consumption in near real time, on their computer or cell phone. The default view shows the current day's energy consumption compared to the previous day's, but the graph can easily be extended further back in time to look for peaks, troughs and other outlying data points. Our tool is free and scalable, and we plan to release the technical specifications (application programming interfaces or "APIs") so anyone can build applications from it. Google PowerMeter is not yet available to the public since we are testing it out with Google employees first. Currently we are building partnerships with utilities and independent consumer device manufacturers to roll this tool out in pilot programs. We are busy collecting data regarding the impact that energy information provided by Google PowerMeter has on electricity savings and consumption, and preliminary results are promising.

There is no one-size-fits-all solution to providing consumers with detailed energy information. It will take the combined efforts of federal and state governments, utilities, device manufacturers, software engineers and non-governmental organizations to empower consumers to use electricity more wisely by giving them access to energy information. We look forward to working with utilities and other industry stakeholders to enable consumers to have a greater understanding of, and control over, their energy use.

Thank you, Mr. Chairman, for the opportunity to testify today. I look forward to working with the Committee in its important examination of ways to build and deploy a smarter electrical grid.