State Clean Energy-Environment Technical Forum
Motivating Energy Efficiency with Metering Technologies
January 22, 2008
Call Summary

Participants: 32 responding participants from 15 states and a number of national organizations

Materials: The participant list, agenda, and all presentation materials from this call are available at http://keystone.org/Public_Policy/2007_8DOCS_CLEANENERGY/2007_8DOCS.html. Please refer to these documents for additional detail on presentations.

Key Issues Discussed

- The benefits of Advanced Metering Infrastructure (AMI) to different stakeholder groups
- The role of home area networks in augmenting effectiveness of AMI
- State efforts to encourage deployment of AMI
- Estimates/studies of demand response resulting from AMI deployment

Summary of Presentations

A. Welcome/Introduction – Julia Miller, Climate Protection Partners Division, State and Local Branch, US Environmental Protection Agency (EPA)

EPA has been receiving questions from states on **advanced metering infrastructure (AMI)** for several reasons, including requirements in the Energy Policy Act of 2005 (EPACT) for states to investigate the feasibility of AMI, the increasing cost of building new generation, growing concerns about reliability issues in most regions of country, and lots of local opposition to construction of new power plants. To address these issues, many states and utilities have been focusing on demand response.

B. Overview of Advanced Metering Technologies, Penetration, and Benefits – David Kathan, Federal Energy Regulatory Commission (FERC)

- Advanced metering **records customer consumption hourly or more frequently and provides for daily or more frequent transmittal** of measurements over a communication network to a central collection point.
- **AMI requires a fixed network that allows for daily polling of all the meters in the network**. There are several technologies that permit this type of data gathering. AMI differs from automated metering reading (AMR), which only allows one-way meter reading.
- In 2006, FERC conducted a survey of marketers, utilities and other load-serving entities and estimated a **6% penetration rate for AMI in the U.S.**, although this varies region by region. **Electric rural cooperatives have the highest penetration**, primarily because the cost of meter reading is higher in rural areas so there are greater benefits associated with employing AMI. **Pennsylvania, Wisconsin, Connecticut, and Kansas have the highest rates of penetration.**
- Based on these and other assessments, FERC has observed **growing overall interest and investment. State activity has also increased**, particularly due to new standards outlined in EPACT.

- AMI functionality is increasing, resulting in **improved demand response, more timely usage data, and better operational efficiencies.** AMI is used most commonly for enhanced customer service, tamper detection, and load forecasting.
- **Outstanding issues and challenges for AMI** include
    - concerns about potentially obsolete technology in the face of new developments,
    - difficult deployment decisions relating to cost-effectiveness, and
    - designing for interoperability and open standards while maximizing flexibility.
- **AMI & Demand Response** - Low advanced metering penetration presents a barrier to expansion of price response programs. The benefits associated with demand response can improve AMI cost effectiveness.
- **AMI & Energy Efficiency**. Real-time usage data provides valuable feedback that can encourage efficient consumption. If combined with time-based rates, customers can reduce peak consumption and a large portion does not shift to other time periods.

Question for David Kathan

What is a home area network, and what is its role in AMI?

A home area network (HAN) is a smart home concept. It is a wireless network that will connect appliances (TV, air conditioner, water heater, etc.) and allow them to be controlled from one place. It involves putting a module inside the meter to be able to interact with price or other information from utilities.

C. California's Advanced Metering Infrastructure Initiative – Moises Chavez, California Public Utility Commission (PUC)

- **In California's Energy Action Plan, demand response was the second priority (after energy efficiency).** California established a goal of meeting 5% of system peak with demand response by 2007.
- **Demand response was the key policy driver for AMI because it is a flexible resource** for improving system reliability, assisting in power purchasing, decreasing individual costs, and protecting investments.
- **Large customers are targeted** primarily because residential customers do not yet have AMI in place, and it was unclear what the demand response potential was for residential users.
- **The state also directed utilities to file AMI project proposals.** These proposals must meet several important functional requirements, must be cost effective, and must include a comprehensive plan that addresses both deployment and integration.
- In 2006, the PUC approved a $1.74 billion AMI project proposed by PG&E, the largest AMI project in the U.S. **The project will deploy 5.1 million electric meters and fixed radio frequency networks for 4.2 million gas meters over the next five years.**
- The PUC also approved a $572 million SDG&E AMI project in 2007 to **install 1.4 million advanced electric meters and 900,000 advanced gas meter modules between 2008 and 2010.** As part of this project, **SDG&E will solicit proposals for a HAN communication interface**, based on an open standard capability for all customers.
- Between 2009 and 2014, SCE's AMI project will install 5.3 million meters in households and businesses with usage under 200 kilowatts. **This final phase of SCE's project will costs $1.7 billion but yield $2.08 billion in estimated benefits.**

Questions for Moises Chavez

Are the AMI deployment plans for gas and electric customers different?

Gas has taken the back burner because a lot of the benefits of advanced metering are focused on the electric side; the benefits for gas are smaller.

Additional response from Dan Johnson: There are some efficiencies for natural gas and electricity if they are used and metered at the same residence at the same time, but time differentiation in costs for gas is not available like it is for electricity. When demand is high in electricity, the wholesale price is increased by a factor of ten, which is not the case for gas.

D. Smart Meter Deployment in Ohio -- Dan Johnson and Greg Scheck, Ohio PUC

- **The Ohio PUC recently completed a series of six workshops on smart meter deployment including vendors of energy equipment and services.** The overarching goals of these workshops were to:
    - identify the best approaches for empowering customers to manage their power costs,
    - capturing utility operational efficiencies, and
    - facilitating improvements in consumer services and reliability.
- The PUC wanted to **analyze whether benefits would exceed costs and explore the feasibility of deploying advanced meters, affecting demand response, and reducing peak demand.**
- **Utilities, consumers, society as a whole, and modern grid stakeholders are all beneficiaries of AMI.**
    - Utility benefits include reduced operating costs, better use data, better theft detection, and improved customer satisfaction. Specific benefits depend on technology choices.
    - Direct consumer benefits accrue as cost savings to those who respond to price signals by shifting and/or reducing consumption. Indirect benefits accrue as cost savings to all consumers due to lower prices in peak periods resulting from lower demand in those periods. Consumers also benefit from more customer information and choices, greater billing accuracy, fewer and shorter outages, and reduced financial losses due to power outages.
    - Societal benefits include financial and environmental gains associated with reduced peak load and increased reliability.
    - Modern grid stakeholders also benefit from better monitoring of the state of the distribution system, leading to better operations and improved work management.
- Experts have examined 31 AMI programs in which advance meters were deployed and demand response was measured to determine whether AMI can yield reductions in energy usage. **These assessments have found that there was an average reduction of 11% in kilowatt hours (kWh) used in those areas where AMI programs are being implemented.** These reductions occur in peak hours, and there is also a carryover effect. Contact information is given below for Chris King and Patti Harper-Sloboszewics, who were the principal reviewers of these programs.
- Duke Energy released a study on anticipated societal benefits if AMI were to become ubiquitous. The study determined that **the initial reduction in energy use by 2010**

would be in the range of 35-187 billion kWh in annual energy savings, with a reduction in carbon footprint of up to 20 million metric tons of CO_2.

Questions for Dan Johnson

How much would consumers need to invest in technology to make HANs work?

This is not yet clear. Standards for HANs have not yet been widely accepted, so it is difficult to estimate technology needs and associated costs.

Additional comments from participants:

- The devices that are attached to appliances for residential homes are not widely available in the market and are expensive due to low demand.
- The market for these devices is underdeveloped. California has not pushed utilities regarding HANs because the future of the market and the technology are unclear.
- Once the market begins to mature, the price should come down. The technology is not particularly sophisticated.
- The Oxford University Centre for the Environment recently published research showing that **providing direct feedback to customers on their electricity usage can result in an energy conservation effect of 5-15%**. More information about this study is available at: http://www.eci.ox.ac.uk/research/energy/downloads/smart-metering-report.pdf

Questions for All Panelists

How does metering influence energy efficiency?

There is a carryover effect from demand response into energy efficiency. Some studies show that vendors who provide these services are able to affect peak demand over the course of several hours. This certainly results in a reduction of peak demand, which for some uses has an efficiency payoff. For example, if you reduce lighting use due to demand response, you don't turn the light on at another time of day to get that light back. Some technologies amenable to demand response will operate at all times, not just during a peak event. For instance, if you have a smart thermostat, you can program it to use less energy at other times as well.

There is also an indirect effect of providing information about usage patterns -- the "wow" effect – which produces increased energy efficiency. If a manager sees a weekly pattern of usage and starts to wonder why there is a spike at 4 p.m. on a Saturday and learns that it's the custodial crew, he may make other choices about when and how to have his building cleaned.

Has AMI actually pushed forward more real-time pricing?

California has a legislative restriction that arose from the state's energy crises that precludes use of that type of a rate structure—at least until the utilities pay some of the energy contracts that they entered into because of the energy crisis.

Time-sensitive rates are mostly used for very large customers because right now they are the only customers who have the ability to record usage and respond every 15 minutes or every hour. There is a lot of resistance to time-sensitive rates. Time-sensitive rates cannot be used unless and until you have the technology to measure use and bill accordingly.

What effect has AMI had on solar photovoltaics?

This is unclear, but one could assume that people with photovoltaics would be able to reduce usage through net metering when the sun is shining. If they are paying real-time prices, photovoltaics become more cost-effective than under average cost pricing.

By lowering prices through deferred generation and more a more efficient distribution system, does AMI counteract energy conservation gains?
It is not clear that any studies have addressed this issue. We may not be far enough along on the curve or sophisticated enough to see that counter-effect. Over time, AMI should dampen volatility in wholesale prices. Over the long term, we would expect to have less difference in price between one hour or one season and the next.

How many studies look at consumer response to deployment of AMI and how are they being integrated into decision making about deployment?
The study that California conducted was a controlled experiment that looked at how customers would respond to a critical peak pricing tariff with and without advanced metering technology. A different study looked at how people would respond to that kind of rate with technology. Results showed a reduction of around 20%, but the results are problematic because that was not a controlled experiment. Technology does play a role, but you need AMI and you have to have home area networks so people can respond.

In Ohio, a number of studies were presented during the workshop series. Most of these studies gave similar results. Response by small consumers and residential consumers are more than most people expect. People from low-income neighborhoods responded at the same rate as other people, as long as they knew what to do and how/when to do it.

Additional expertise and information on demand response and AMI are available from:

- **Patti Harper-Slaboszewicz**; Utilipoint. (505) 797-5475 or (505) 934-6896; pharper-s@utilipoint.com; www.utilipoint.com
- **Dan DeLurey**; dan.delurey@dramcoalition.org
    - US Demand Response Coordinating Committee; http://www.demandresponsecommittee.org
    - Demand Response and Advanced Metering Coalition (DRAM); www.dramcoalition.org.
- **Ahmad Farouqui**; The Brattle Group; (415) 217-1026
- **Chris King**, eMeter; chris@emeter.com

How have rates changed in California? Did AMI costs find their way into rates?
For PG&E, yes. Costs are generally front-loaded and then recovered over time. In the case of PG&E, the rate increase was about 1% of overall of revenue requirements.

Where should people go to get specifications for AMI?
Talking to utilities would be a good first step, since they will be the ones deploying metering. The Interoperability Council and other grid experts would also be good contacts, as would state PUCs. The GridWise Alliance is a group that is working toward implementing and promoting the smart grid concept, and the GridWise Architecture Council is a think tank. These would be good resources as well.

NEXT TECHNICAL FORUM CALL: February 14th, from 2:00 p.m. to 3:30 p.m. ET
TOPIC: National Action Plan on Energy Efficiency: A Vision for 2025