Smart Policies Before Smart Grids:

How State Regulators Can Steer Investments Toward Customer-Side Solutions

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Abstract

The Smart Grid holds promise as an enabler of customer-side resources – energy efficiency, demand response, and distributed generation and storage. Together with utility measures to more precisely control electricity on the grid, improve integration of renewable resources and support electrification of the transportation sector, the Smart Grid can help reduce carbon dioxide to levels that significantly lower the risk of dangerous threats to the climate.

But without the right policies, the Smart Grid will simply divert attention and funds from carbon reductions achievable today with clean energy resources.

State regulators are key. They have broad authority to establish the requirements that are needed to tap the full potential of Smart Grid technologies that consumers will be paying for. And they can ask tough questions about whether proposed investments will, in fact, save energy, increase development of clean supply-side resources and reduce greenhouse gas emissions.

Introduction

According to a recent Harris Poll, two-thirds of Americans have never heard of Smart Grid, and about the same percentage has never heard of a smart meter. That's despite nearly four billion dollars committed under the American Recovery and Reinvestment Act of 2009 (H.R. 1, 111th Congress) to jump-start the technologies and applications that together comprise the Smart Grid, plus matching funds required from consumers through their utilities.[1] On the other hand, two-thirds of Americans agreed with the statement, "If I could see how much electricity I was using I would be more likely to reduce my usage."[2] But seeing electricity use closer to real-time won't turn into energy savings without policies and programs that address the myriad of barriers to energy efficiency.

Energy efficiency is among the federal government's objectives in the Recovery Act of 2009 (HR 1, 111th Congress) for modernizing the US electric grid. But why are utilities investing in Smart Grid? According to a recent survey, grid reliability is the number one driver, with demand response/peak shaving ranking second. Customer demand for visibility/control of energy bills and integrating renewable and distributed resources ranked near the bottom, at seventh and eighth place. Deferring construction of new power plants and lines – related to peak demand reductions – ranked fifth.[3] Though not mentioned, for investor-owned utilities the opportunity to earn a return for shareholders on large Smart Grid investments is certainly another driver.

Clearly, energy efficiency and emissions reductions are not top of mind. If these potential benefits are not considered from the start, savings opportunities will be wasted and the Smart Grid will not live up to its promise. (Moskovitz & Schwartz 2009)

It's also important to be mindful of utility incentives and disincentives. Which investments are most profitable? How do customer-side resources affect a utility's bottom line? What's best for customers? Are utilities foregoing more valuable investments in clean energy?

Smart Grid can engage many, quickly, but it is only an enabler. State regulatory utility commissions have broad authority to set rates for recovery of utility investments in Smart Grid consistent with the interest of ratepayers and the public. They oversee the investor-owned utilities that supply 60 percent of the electricity in the U.S.[4] and set important policies for customer-side resources even in deregulated markets.

This paper explains how Smart Grid can increase energy savings and reduce greenhouse gas emissions – focusing on energy efficiency, demand response, and distributed generation and energy storage – and policies state regulators should consider to achieve those benefits.

1 See http://www.energy.gov/recovery/smartgrid_maps/SGIGSelections_State.pdf; http://www.energy.gov/news 2009/documents2009/SG_Demo_Project_List_11.24.09.pdf.

2 See Harris Interactive, Feb. 25, 2010, at http://news.harrisinteractive.com/profiles/investor/ResLibraryView.asp? BzID=1963&ResLibraryID=36455&Category=1777.

3 Pacific Crest Mosaic Smart Grid survey, conducted July 2009, reported Nov. 4, 2009, at www.smartgridnews.com.

4 See http://tonto.eia.doe.gov/energyexplained/index.cfm?page=electricity_in_the_united_states#tab2.

What Is the Smart Grid and What Does It Have to Do With Clean Energy?

The Smart Grid is an interconnected system of information and communication technologies and electricity generation, transmission, distribution, and end-use technologies that has the potential to enable consumers to:

1. manage usage and choose the most economically efficient energy service offerings;

2. enhance delivery system reliability and stability through automation; and

3. improve system integration of the most environmentally benign generation alternatives, including renewable resources and energy storage. (Levy 2009)

For example, Smart Grid's communications and control capabilities might allow utilities to optimize voltage and reactive power on the distribution lines that deliver power to homes and businesses, minimizing energy losses. Smart Grid also can help consumers use energy efficiently by providing usage and cost information in near real-time as well as highly customized analysis and energy-saving tips – if the requisite policies and investments are in place. And a Smart Grid can dynamically manage variable renewable generating resources, generation and energy storage at customer sites, and charging and discharging of plug-in electric vehicles.

The Smart Grid is rolling out in pieces. Many utilities are making advanced metering infrastructure (AMI) their first step. AMI includes solid-state electronic meters that record consumption at hourly or shorter intervals, a communications system that delivers the data to the utility at least daily and transmits commands to the meter, and a meter data management system that receives and stores the interval data. The Smart Grid technology suite also includes sensing and measurement technologies, advanced components (superconductivity, storage, power electronics and diagnostics), distribution automation systems, end-use technologies like smart appliances and advanced control systems for buildings, remote electric service disconnect/ reconnect, distributed resources, and integrated communication systems throughout.[5]

Smart Grid can reduce utility operating costs[6] and improve electric service reliability.[7] Research is underway on its potential to support higher levels of energy savings, renewable and distributed resources, and electrification of the transportation sector, as well as the associated reductions in greenhouse gas emissions.

Reducing greenhouse gas emissions 80 percent by 2050, consistent with the American Clean Energy and Security Act passed by the U.S. House of Representatives in June 2009, requires de-carbonizing our energy systems. A recent study for the U.S. Department of Energy (DOE) by Pacific Northwest National Laboratory (PNNL) estimated the technical potential[8] in 2030 for energy savings and associated reductions in carbon dioxide emissions from Smart Grid deployment. Assuming 100 percent penetration of the required technologies, PNNL estimated that Smart Grid-enabled energy-saving measures would directly reduce U.S. energy consumption and emissions by 5 percent. (PNNL 2010) Other potential studies have estimated similar levels of savings. (EPRI 2008; Hledik 2009) Because Smart Grid deployments are just getting underway, any estimates of their potential benefits are preliminary.

[5] For an overview of Smart Grid technologies and applications, see National Association of Regulatory Utility Commissioners, 2009, *The Smart Grid: Frequently Asked Questions for State Commissions.*

[6] Reducing meter reading and outage management costs and shaving peak load, for example.

[7] How much consumers are willing to pay for increased reliability – and whether Smart Grid can address a utility's particular reliability problems – are less apparent.

[8] As a general rule, only a portion of the technical savings potential is considered achievable given barriers to implementation such as cost.

Smart Grid and Energy Efficiency

Smart Grid's energy efficiency benefits are primarily expected in the following areas.[9]

Information-Driven Savings

Today, without any Smart Grid technology, most customers simply receive a monthly electric bill that shows their monthly energy usage and cost. They can't easily correlate specific actions with energy consumption or bills. Some utilities and third parties provide analysis of the monthly data using weather, demographic and other information, as well as customized energy-saving tips. A report is delivered to the consumer by mail or is made available on-line.

Smart meters and smart thermostats enable breakdown of consumption by end use and time of use – and more targeted analysis and recommendations. Consumers also may be able to sign up to receive alerts when consumption or costs exceed designated values. "Feedback devices" such as Web-based portals and in-home displays can show hourly (or more granular) consumption data from smart meters in real-time or day-after – as well as current prices – and provide energy- and money-saving ideas.

International experience with feedback devices found that frequency and specificity of the feedback (such as appliance-specific breakdown) were influential variables in helping consumers change their energy consumption behavior. Those findings tend to favor smart meters and two-way communication networks. Based on prior reviews of field studies (including Faruqui, Sergici & Sharif 2010), PNNL estimates the technical potential for electricity savings for homes and small/medium commercial buildings from improved feedback enabled by the Smart Grid at 6 percent. Importantly, PNNL indicates a wide range of uncertainty for potential Smart Grid savings in this area – 1 percent to 10 percent. That's due to a number of limitations of studies to date: self-selection bias, small and homogeneous samples, lack of research into sustainability of savings over time, and shortcomings in evaluation to determine how savings were actually achieved. (PNNL 2010)

Enhanced Evaluation, Measurement and Verification (EM&V)

EM&V is increasingly important as utilities, third-party providers and capacity markets reach for advanced levels of energy efficiency to meet customer needs. Many states now have energy efficiency resource standards that ramp up over time, and a number of states provide performance-based incentives that encourage utilities to achieve the highest levels of savings.

In addition to quantifying energy and peak savings and determining performance incentives and penalties, EM&V also is used to assess cost-effectiveness, set savings goals, identify receptive market segments, assist in cost recovery determinations, assess potential energy-saving measures in integrated resource planning, and for program planning, budgeting and design, among other uses. (Goldman, Messenger & Schiller 2010)

Smart Grid benefits for energy efficiency EM&V stem from interval consumption data provided by smart meters, together with signals from smart thermostats:

- Disaggregation of heating and cooling loads from other loads
- Reduced data collection costs
- Rapid feedback on new or expanded energy efficiency programs
- More refined load-shape characteristics of individual energy efficiency measures
- Better information for targeting programs to diverse customers
- More accurate baselines and estimated savings – and how and why they happened

[9] Beyond reducing peak loads, a side effect of some demand response programs is overall reduction in energy use.

Continuous Building Diagnostics

Building "commissioning" is a systematic process of ensuring that all systems are designed, installed, functionally tested, and capable of being operated and maintained as the owner intended. "Retro-commissioning" applies a similar process to existing buildings. Generally performed only for large commercial buildings, commissioning covers heating, ventilating, and air conditioning (HVAC) systems and controls, lighting and life safety systems. For new buildings, the process begins at the design phase and continues through construction, start-up and the initial period of operation.

Automated diagnostic tools can detect problems in HVAC and lighting systems on an ongoing basis. Only a fraction of buildings are using them because of complexity, cost and other issues. The Smart Grid is not a requirement for continuous diagnostics, but Smart Grid investments can potentially make the practice available to all consumers, particularly if a common data platform is developed and historical interval data are stored for future use. (Friedman 2009)

PNNL estimates that using Smart Grid technologies for continuous diagnostics could reduce electricity used for home heating and cooling by 10 percent to 20 percent, and reduce consumption for HVAC and lighting for small and medium commercial buildings by 10 percent to 30 percent.[10] Using Smart Grid's real-time communications, consumers and building operators can receive alerts of abnormal loads immediately. A comprehensive program can recommend actions to correct the problem, the likely cost range, any rebates for energy-efficient equipment or measures, and potential savings. Alerts also can be provided for routine maintenance schedules. (PNNL 2010)

These same capabilities can monitor and analyze building operations to identify opportunities for improving energy efficiency of buildings.

Conservation Voltage Reduction

The distribution lines that deliver energy to homes and businesses typically lose 3 percent to 7 percent of the electricity they carry.[11] Smart Grid's control and communications capabilities might enable greater reductions in line losses through tighter control of voltage and reactive power. (Schwartz 2010)

Reducing electric service voltage also reduces energy consumption of some consumer equipment. In fact, much of the savings potential may be on the customer side. A study sponsored by the Northwest Energy Efficiency Alliance (Alliance) involving 11 utilities, 31 feeders and 10 substations found that when voltage reduction is coupled with major system improvements, 10 percent to 40 percent of the savings accrue on the utility distribution system; the remaining savings are the result of reduced consumption by equipment in homes and businesses operating at lower voltage. (R.W. Beck 2007)

While system operators may be used to considerable slack above minimum voltage standards, more precise controls and communications allow for margins to be smaller without compromising service quality or damaging consumer equipment. "Conservation voltage reduction" is the general term for the changes to distribution equipment and operations that can reduce line losses, peak loads and reactive power needs, and save (or defer) consumption by some types of consumer equipment. Smart Grid technologies are not a prerequisite, but they may be able to increase energy savings.

PNNL (2010) estimates that Smart Grid technologies could potentially increase energy savings from these mechanisms by 2 percent. The figure is based on the research sponsored by the Alliance, combined with engineering estimates for the dynamic optimization of voltage and reactive power. Initial results from EPRI's Green Circuits study indicate average energy savings of between 2 percent and 3 percent. (Forsten 2009)

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10 PNNL did not attribute any incremental savings to Smart Grid-enabled diagnostics in large commercial buildings, in part because researchers did not view simple, uniform diagnostics to be well-matched to custom-designed and complex HVAC systems.

11 EPRI, "Green Circuit Field Demonstrations," 2008.

Smart Grid and Demand Response

Demand response is defined as "Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized." (The Brattle Group *et al.* 2009)

In the past, demand response generally was limited to the *utility* controlling a few residential end-uses, such as air-conditioning and water heating, and to programs for large customers such as interruptible rates and demand "buyback." Programs focused on the retail market and relied on financial incentives to attract customer participation.

Smart Grid allows customers to become more involved in how and when they use energy. AMI provides the interval data required to offer dynamic pricing that reflects at least hourly variations in power costs and give customers useful information on energy patterns and ways to reduce and shift energy use. Smart thermostats and other new technologies enable more customer control over consumption. Consumers can set their own controls to automatically respond to high price periods when they receive a signal from the utility or a third party. Smart Grid also offers new opportunities for consumers to participate in both retail and wholesale markets for energy, capacity and ancillary services. (Levy, Goldman & Sedano 2010)

A recent assessment of demand response potential in the U.S. estimated that simply continuing current demand response programs would reduce peak demand 4 percent by 2019, compared to a scenario with no demand response programs. The study also gives projections under various scenarios that combine AMI, dynamic pricing and enabling technology that automatically adjusts loads in response to prices. Compared to a no demand response scenario, the study found that peak load may be reduced:

- By 9 percent with expanded demand response programs plus 5 percent of customers participating in dynamic pricing
- By 14 percent with full AMI deployment and the majority of customers on dynamic pricing and using enabling technology
- By 20 percent if all customers remain on dynamic pricing and use enabling technology, where cost-effective (The Brattle Group *et al.* 2009)

Reducing peak loads through dynamic pricing and other Smart Grid-enabled demand response programs may offer large operational savings. It also acts as a check on generator market power and market prices.

But the net impact of demand response on carbon emissions depends on the mix of plants serving loads at any given time. For example, Smart Grid-enabled demand response can shift electricity production from less efficient peaking resources to more efficient natural gas plants with lower carbon emissions. On the other hand, if demand response shifts usage to more carbon-intensive base load resources, greenhouse gas emissions may rise. (PNNL 2010)

Achieving consistently high levels of peak load reduction through dynamic pricing requires automating the customer's response. Even more critical is educating consumers. Consumers are capable of responding to pricing if appropriately prepared. But they must see the benefits that the new systems and rates can provide them. Education is time-consuming and expensive, but cannot be given short shrift.

Smart Grid and Distributed Energy Resources

Today's electric system is designed to produce power at large, centralized facilities and deliver it on long-distance transmission lines to the lower-voltage distribution systems that serve retail customers. It was not designed with dispersed generation in mind.

With costs declining for solar photovoltaic and other small-scale renewable energy systems, and increasing interest in potential local economic development benefits, some states are encouraging clean distributed generation through resource-specific set-asides in renewable portfolio standards, feed-in tariffs, net metering and other programs. Distributed energy resources also include combined heat and power facilities, which generate electricity locally and capture the waste heat for industrial processes or other thermal needs, and waste energy recovery, which recycles heat from industrial processes to generate electricity. These distributed resources save energy and have the potential to significantly reduce greenhouse gas emissions.

Distributed energy storage – from customer sites to substations – complements both distributed and central-station generation. Technologies such as advanced batteries and right-time charging/discharging of plug-in electric vehicles can reduce peak demand, improve load factor, improve reliability, and increase system flexibility by smoothing out the ups and downs of variable generation.

A more sophisticated distribution system will better accommodate heavier penetration of distributed energy resources. Smart Grid's intelligent sensors, software, two-way communications and advanced controls can react instantly to variable generation from distributed generators, dynamically integrating it with other supplies and loads to minimize line losses, provide voltage support and improve reliability. During utility system outages, Smart Grid technologies can allow distributed generation to continue providing electricity to "micro-grids" that seamlessly isolate themselves from the system, then automatically resynchronize and reconnect to the system when conditions return to normal. Smart Grid technologies also may enable more streamlined interconnection of distributed generation and integration with building energy systems. And smart meters provide generation data by time of day, allowing rate designs that better support solar electric systems.

At the same time, utility distribution systems – assembled without foresight of two-way power flows – were not designed to accommodate distributed resources. For example, transformers sized to serve several houses in a neighborhood may need to be changed out to accommodate high levels of distributed generation and electric vehicle charging. Those costs should be considered when comparing distributed resources to other clean energy alternatives.

Smart Policies Before Smart Grids

Regulators' attention on Smart Grid is largely focused today on the investments coming before them for cost recovery. In addressing those requests, and in proceedings on fundamental energy policies and regulations, regulators should keep their eyes on the prize – least-cost/least-risk energy, capacity, and transmission and distribution (T&D) resources with the least impact on the environment.

Smart Grid technology is an enabler of cost savings, improved reliability, increased energy efficiency and emissions reductions. In some cases potential Smart Grid benefits are automatic. But in most cases they can only be realized if combined with smarter policies, many of which can and should be adopted with or without Smart Grid investments.

Here's a sampling of the policies that are urgently needed to prepare for a low-carbon future, including both high-level policies and those focused on substantially scaling up energy efficiency, demand response and distributed resources to ensure best use of Smart Grid investments.

Consider Environmental Goals in Energy Regulation

The captivating vision of a fully implemented Smart Grid represents a fundamental paradigm shift for how we build and use the electric system. It means much more efficient use of electricity, more distributed demand and supply options, and a significantly smaller environmental footprint. Getting there will require smarter regulation generally and in particular broadening the utility regulator's mandate to consider environmental goals.

Energy and the environment are inextricably linked. Explicit consideration of the environmental costs and benefits of Smart Grid investment is not only reasonable, but necessary to meet the enormous challenge of climate change.[12]

Policymakers at the state and federal levels should review power sector regulations to determine where they are working in concert with carbon reduction and other environmental goals, and where they are working at cross purposes. Regulators should revamp the regulations if they find they are in conflict with the emissions reductions that scientists say we must achieve to avoid the worst effects of climate change.

For example, environmental goals such as reducing greenhouse gas emissions are considered to some extent in resource planning and procurement in many jurisdictions. But additional rules and regulations are needed to meld energy and environmental goals in these processes. A case in point: Nine of the 10 Northeast and Mid-Atlantic states that participate in the Regional Greenhouse Gas Initiative (RGGI), the first mandatory cap and trade program in the U.S., also participate in the ISO New England or PJM forward capacity markets. But there are no rules in place to consider the carbon footprint of the resources acquired in those markets. In fact, capacity auctions as currently designed can breathe new economic life into high carbon-emitting power plants that were previously planned for significantly reduced operations or retirement. Nor has RGGI resulted in operational changes by generators participating in the energy markets that these capacity markets supplement. (Gottstein & Schwartz 2010)

Acquire All Cost-Effective Energy Efficiency

By and large, energy efficiency is the cheapest resource, and there are ample supplies at cost-effective levels. Energy efficiency also decreases carbon emissions because (by definition) it reduces energy use for an equivalent level of service, and at the margin most power systems run higher-carbon resources.

Some states permit the level of investment in energy efficiency to remain far below what is easily achievable and cost-effective. That is at odds with the rationale behind many Smart Grid investments.

As a matter of law or through regulation of utilities, states should either adopt energy efficiency resource standards with aggressive targets for cumulative energy savings or require utilities (or third-party administrators) to acquire all cost-effective energy efficiency. Funding levels must match these goals.

Treat Demand-Side Resources on a Par With or Superior to Supply Alternatives

The goal of resource planning and acquisition – whether at the utility, state or regional system-operator level – should be the best combination of cost, risk, uncertainty and environmental impacts for retail electric consumers who ultimately pay the bill. Demand-side resources – energy efficiency, demand response, and distributed generation and storage – should be treated on a par with or as superior to other resources in integrated resource planning/portfolio management and competitive bidding processes for energy and capacity.

For example, energy efficiency and demand response resources compete directly with supply-side resources in the ISO New England and PJM forward capacity auctions. Similarly, as described further below, demand-side resources should be considered where they may prove economical for replacing or deferring planned T&D system upgrades.

Align Utility and Consumer Interests

Under standard ratemaking, utilities have an *incentive* to encourage consumers to increase energy consumption in

[12] The compelling need to empower utility regulators to consider the environment is not limited to Smart Grid issues. Clean energy resources — those that minimize air and water pollution, toxic waste streams, and land- and water-use impacts — should get every reasonable preference over resources that have greater environmental impact. Policies must be developed to consider the environment throughout the power production and delivery chain.

order to increase profits, as well as a *disincentive* to promote energy efficiency. This incentive structure is wholly inconsistent with the vision of a Smart Grid.

A small reduction in energy sales can mean a large reduction in utility profits. That's because utilities recoup a large portion of fixed costs through consumption-based rates, and most utility costs are fixed in the short run and do not vary with changes in consumption (sales). This powerful "throughput incentive" stands in the way of achieving high levels of energy efficiency.

The throughput incentive applies both to energy efficiency programs for customers as well as efficiency improvements to the utility distribution system that reduce consumption by consumer end-use equipment. A similar incentive applies to non-utility-owned distributed generation at the customer's premise, which reduces sales and provides no opportunity for the utility to earn a return on investment. The throughput incentive also applies to demand response. For example, rates under dynamic pricing are designed to be revenue neutral assuming no change in the pattern of energy use. But if the rate design is successful, consumers will reduce usage during high-priced hours, resulting in declining utility revenue. (The Brattle Group *et al.* 2009)

"Decoupling" is a ratemaking mechanism that breaks the link between how much energy a utility sells and the revenue it collects to cover fixed costs.[13] Because it aligns the utility's business model and consumer interests, it can help optimize customer-side resources and Smart Grid investments.

Under decoupling, the prices computed in the utility's rate case are adjusted periodically to keep the utility's revenue at the allowed level, reflecting differences between the forecasted units sold (in the rate case) and actual units sold. (Shirley, Lazar & Weston 2008) Decoupling price adjustments for electric and natural gas utilities tend to be small – typically under 2 percent of the total retail rate, positive or negative, with the majority under 1 percent. (Lesh 2009)

Decoupling removes the utility's *disincentive* to embrace customer-side solutions, but does not provide any *incentive* to go after them. Several states and regulatory commissions have adopted performance incentives that give the utility an opportunity to earn a return on energy efficiency investments. Some performance incentives cover both energy and demand savings, motivating utilities to reduce peak demand, as well. The best incentive programs provide clear performance metrics and align financial risks and rewards for those metrics. (Shirley, Lazar & Schwartz 2009)

Integrate Smart Grid With Rate Design and Demand-Side Programs

Smart Grid-enabled demand response won't magically happen just because customers get shiny new meters that can record hourly energy use. To optimize consumer behavior and system operations, regulators should:

- Let customers choose a dynamic pricing option that varies according to market prices and system conditions. Commissions should focus on rates that reduce overall utility costs, encourage customers to shift and reduce peak loads long-term, and support clean demand-side resources.

- Make it easy for customers to shift energy use from peak load hours. To achieve the full promise of time-varying pricing, consumers must have technologies such as smart thermostats that automate their response. A recent survey of experiments on one form of dynamic pricing, critical peak pricing, found that customers with enabling technologies reduced peak demand by 27 percent to 44 percent, compared to 13 percent to 20 percent without such technology. (Faruqui & Sergici 2009)

- Coordinate demand response and energy efficiency programs so customers understand how to permanently reduce their peak loads through energy-saving measures (or clean distributed generation).

Ensure Access to Usage Information

Data accessibility policies are needed that spell out the rights of consumers to access, protect and share their smart meter-enabled energy usage data as well as the rights of third parties, with suitable privacy protections, to obtain the data so they can offer customized energy efficiency,

[13] Costs that vary directly with consumption and production – fuel, variable operation and maintenance, and purchased power costs – typically are excluded from the decoupling mechanism. Fuel and purchased power costs often are addressed through a separate adjustment mechanism.

demand response, and distributed resource products and services to consumers.

Most utilities that are installing smart meters and intend to provide customers with Web access to their energy usage data generally do not have clear plans for doing so.[14] Even fewer utilities are subject to requirements to provide the data to third parties.

Regulators should develop rules as soon as possible to address these issues. Texas and California are among the early movers.

The Texas Legislature established that consumers own their usage data (HB 2929, 2005 Legislature), and the Texas Public Utilities Commission established rules specifying how consumers will receive information collected by smart meters, including the required capability to communicate with devices inside the premises.[15]

The California Public Utilities Commission established information disclosure policies in advance of utility AMI roll-outs and recently ordered that by the end of 2010, the three largest regulated utilities must provide energy usage data to consumers and the third parties approved by them. In addition, the utilities must let customers access their information through an agreement with a third party by the end of 2010, if sufficient privacy and security measures are in place. Customers with smart meters, and authorized third parties, must have access to usage data on a near real-time basis by the end of 2011. The Commission also will consider whether to require compliance with forthcoming standards by the National Institute of Standards and Technology on access to energy information. And the Commission is developing rules to provide customers and authorized third parties with retail and wholesale prices, in a machine readable form, on a real-time or near real-time basis by the end of 2010.[16]

Reveal the Locational Value of Customer-Side Resources

If a smarter grid boosts at least some customer-side resources, will consumers and the marketplace as a whole know where those resources would do the most good? Will those resources be able to compete fairly with traditional T&D investments?

Distribution system costs in particular make up a large portion of customer bills. Annual construction budgets for generating resources for vertically integrated utilities often pale in comparison to distribution system project budgets.

Some organized markets[17] use "locational" pricing to pay (or charge) more or less for capacity resources and delivery service in specific zones. Generally, however, at best only the utility knows the value of energy efficiency, demand response, and distributed generation and energy storage at specific locations on its system. Further, consumers and third parties have no incentive to develop customer-side solutions in areas where the utility would otherwise make

14 See comments of eMeter Corporation before the Federal Communications Commission, GN Docket Nos. 09-47, 09-51 and 09-137, Oct. 2, 2009. The eMeter survey included 25 utilities deploying AMI (excluding California).

15 Tex. Util. Code Ann. § 39.107(b) (2007); P.U.C. Subst. R.25.130.

16 See Decision 09-12-046 in Rulemaking 08-12-009, Dec. 29, 2009, at http://docs.cpuc.ca.gov/word_pdf/FINAL_ DECISION/111856.pdf.

17 Power markets with an Independent System Operator or Regional Transmission Organization that operates a regional energy market, capacity market or both.

more expensive T&D investments.

Utilities should be required to consider economic customer-side solutions as alternatives for major planned upgrades to the T&D system. Screening guidelines should be developed for determining whether a planned grid investment is a candidate for such alternatives. Guidelines also should be established for analyzing alternatives for cost-effectiveness, reliability, environmental impact and other objectives. Commissions can require utilities to periodically file a list of all proposed major distribution system upgrades and their levelized cost per kilowatt – and what load reduction, by what date, would allow those investments to be deferred. Utilities also can be required to report areas with the worst reliability record by substation and feeder. These areas may be candidates for distributed resources, such as energy storage, that can reduce peak loads and improve reliability. (Shirley 2001). RFPs are another mechanism for determining whether customer-side resources are more cost-effective for relieving congestion and improving reliability than major grid upgrades.

Credits for customer-side resources that defer T&D investments should be provided only until the T&D upgrades can no longer be deferred. The amount of the credits should not exceed the savings from deferring or avoiding the upgrades. Further, credits for distributed resources and demand response should be tied to operation during the peak hours for the congested transformer, feeder or substation.

Such measures would allow consumers and third parties – solar panel vendors, demand response aggregators, energy service companies and third-party efficiency providers – to develop projects in the most beneficial locations for the grid and receive a portion of the cost savings from deferred T&D system projects.

Conclusion

Smart Grid technologies and applications will deliver some energy savings automatically, but most of the potential benefits – for energy efficiency, demand response, distributed resources and the climate – will require policy support, targeted programs and adequate funding.

Smart Grid investments will be cost-effective only if their many benefits outweigh the substantial cost. Regulators and consumers need to know how the Smart Grid will deliver these benefits and make electric bills manageable. Customer engagement is essential. Assistance and information must be available to enable consumers to take advantage of options and functions enabled by the Smart Grid.

Acquiring all cost-effective energy efficiency is the most basic and critical policy to support Smart Grid-enabled energy savings. Consumers must have dynamic pricing options and automated controls to achieve the highest levels of peak demand reductions that the Smart Grid can make possible.

Policies also are needed to support clean distributed resources. Beyond the policies described in this paper, regulators must establish streamlined interconnection standards and sales and net metering arrangements with utilities that encourage consumer and third-party investment.

At the highest policy level, regulators should recognize that energy and environmental goals are interlocked. They can take a long view to ensure that Smart Grid and other energy investments are not wasted and that power sector regulations are not working at cross purposes with climate protection goals. The payoff is saving customers money in the long run and preserving environmental quality.

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