Electricity Advisory Committee

MEMORANDUM

TO: **Honorable Patricia Hoffman, Assistant Secretary for Electricity Delivery and Energy Reliability, U.S. Department of Energy**

FROM: **Electricity Advisory Committee**
Richard Cowart, Chair

DATE: **June 6, 2013**

RE: **Recommendations on Consumer Acceptance of Smart Grid**

Introduction & Overview

The Electricity Advisory Committee (EAC) recently completed and submitted a paper on the Smart Grid (SG) and recommendations for the U.S. Department of Energy (DOE) to consider in supporting and fostering SG progress. One of the most significant issues associated with adoption and implementation of SG technologies and strategies is the reaction of the end-use consumer. Utilities and regulators have a primary role in determining SG policies and investments, but without full consideration of end-use consumer acceptance utilities, regulators are in a sense "flying with significantly reduced visibility." Consequently, the EAC identified the need for a second paper that would analyze consumer acceptance issues more fully and provide detailed recommendations on this topic.

The focus of this paper is on metering infrastructure and systems installed inside homes and businesses. For many utilities, the installation of meters and provision of tools to help consumers manage their energy use and costs generally have not been controversial issues. Leveraging the experience of several utilities that have encountered consumer resistance, later-adopting utilities and their regulators have been able to craft policies and communication strategies to help better inform end-users about the benefits that the Smart Grid can deliver.

One important dimension of this issue is the critical difference between near-term and long-term communications with end-use consumers. Years from now, when SG benefits are achieved through a widespread dissemination of market signals to end use devices, end-users will be able to leverage greater flexibility over when they use

power without impacting the services they receive. In this context, discussions of consumer acceptance can extend beyond a focus on consumers' interactions with today's Smart Grid systems. To achieve this long-term goal, the DOE should give priority to advancing the adoption of smart consumer tools through dialogue among Regional Transmission Operators, Independent System Operators, utilities, device manufacturers, regulators, and other stakeholders as well as the development of appropriate standards. These smart tools have the potential to provide significant grid operational benefits, help the consumer control energy use, while also managing end-user privacy and security.

In the next several years, most end-use consumers will not have a suite of smart devices and robust price signals. In this nearer term context, utilities and regulators face a challenge of how to manage this "Bridge to the Future." As stated earlier, while many have learned from the initial pushback to SG deployment, the documentation and dissemination of these lessons is a role that could be well suited to the Department. The nascent stage of SG installation and implementation strategies makes it imperative to leverage the experience to date and identify strategic recommendations to ensure SG education and outreach evolves to be effective over a broad range of end-use audiences. There is a growing recognition within the utility industry that improving the understanding of end-use customers is a necessary prerequisite to success on a variety of fronts: energy efficiency, demand response, distributed generation, as well as other end-use initiatives. Ultimately however, the degree to which consumers accept and embrace Smart Grid technologies may be a function of utilities' understanding of end-use consumer behavior and decision-making.

Another near-term driver is the investment cycle of the electric power industry. Demand optimization strategies that improve utility load factors offer large potential economic benefits and, given the development of SG globally, could be important to U.S. competitiveness in the global economy. Future progress supporting and fostering SG acceptance with end-users will complement the ability of utilities to achieve needed infrastructure investment.

This paper provides an overview of the critical issues that affect consumer acceptance of the Smart Grid and provides a series of recommendations for the Department to consider. While this discussion has a near-term focus, as SG tools and policies advance geographically and market accessibility in the coming years, the Department should strive to adapt SG education and outreach to address the relevant issues as they evolve.

Issues Experienced in the Early Phases of Smart Grid Development

As electric utilities have moved to install smart meters on their distribution systems, several organizations have encountered concerns from a number of retail customers, resulting in some resistance from concerned groups of highly vocal customers conversant with the use of the internet as an organizing tool. This has been the case for utilities large and small, regardless of business model: investor-owned, government-owned or cooperatively-owned. In some cases, customer pushback has been substantial enough to greatly complicate and delay meter installations.

It is therefore vital that utilities planning such installations include in their implementation plans a well thought out and detailed consumer education program. Smart grid installations need to be done with customers, not to customers. End-users have to understand the advantages of these new technologies to them *personally*, not just to the utility or to customers in general. It is also important that consumers be able to see these advantages in the short-run, such as improvements in reliability and reduced outage times, regardless of whether they, as an individual, change their consumption behaviors in any way. Increasingly, customer segments will accept innovations such as time differentiated or dynamic pricing and peak load reduction programs that smart meters facilitate. In the near-term, however, attempting to sell smart meter installations to retail customers based primarily on the ability to manage their energy consumption and bill alone can be insufficient or, if it appears to involve utility control over their energy use, counterproductive. Many customers are not particularly receptive to imperatives that limit when they should use electricity and for what purpose. Utilities planning to do broad-scale smart grid installations should have an intuitive understanding of their customers' perspectives, especially those unaccustomed to new technology. This will enable utilities to design roll-out plans and consumer education campaigns that speak to consumers effectively and address their needs and concerns adequately. Smart Grid installations should empower consumers and expand their choices.

Effective Outreach & Communication Strategies

It is imperative that the right communication and engagement strategies be identified to help end-users understand and accept the benefits of the Smart Grid. Without consumer acceptance, investment benefits in the Smart Grid may not be realized, and in fact, individuals and groups who wish to criticize the Smart Grid will be empowered. It must always be a guiding principle that education and outreach materials and experiences be developed and communicated in an objective manner reflecting elements germane to an issue.

The benefits end-users can realize through the Smart Grid include, though are not limited to the following:

- Reduction in outages (and outage duration) better outage information for customers, and enhanced system reliability
- Better information to end-users to enable them to better manage their energy use, i.e., better signals to end-users to buy and use electricity when it most benefits system operators and end-use consumers
- Ability by utility to deliver enhanced Demand Response, Energy Efficiency & Distributed Renewables and Generation Programs that benefit consumers
- Ability by utility to avoid/defer the need to build or upgrade Transmission & Distribution Facilities and thus reduce long-run costs to consumers

Explanations of these benefits may need to be customized for different stakeholders and groups using specific communications approaches to best help end-users understand the benefits of SG. Most consumers do not understand how the electric grid operates, nor do they need that comprehensive familiarity. Consumers can still understand how the Smart Grid will benefit them, and choose to participate in individual Smart Grid programs such as dynamic pricing.

There is an increasing body of knowledge developed by utilities, states, and regulators regarding how best to educate and reach out to consumers when doing Smart Grid planning and installations. It has been a long time challenge for utilities to understand how end-users process energy management information and make relevant investment decisions. Quite simply, utilities need to better understand consumer behavior and decisions drivers through much more detailed market research, and to tie the benefits of Smart Grid to those wants and needs.

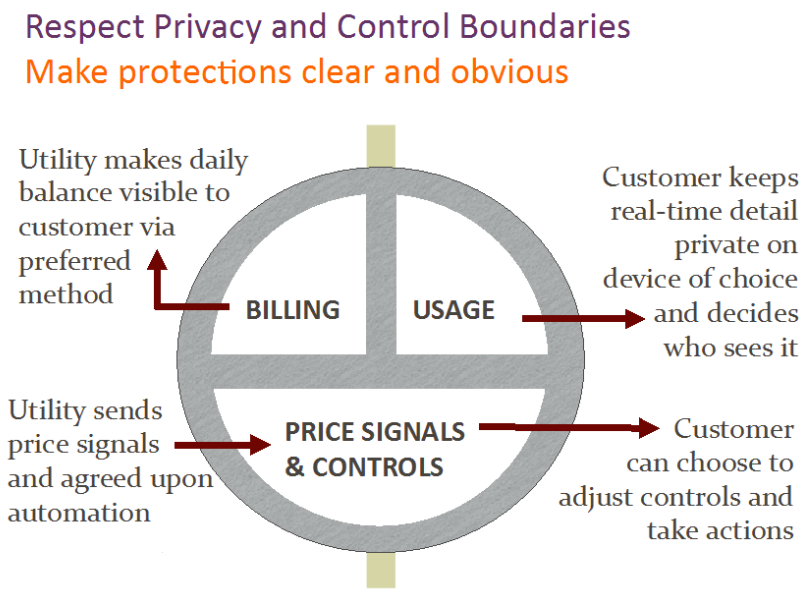
As utilities have gone ahead with Smart Grid implementations, some of the key lessons learned include:

- The primary responsibility to design, lead and implement Smart Grid education and outreach best resides at the individual utility and state level with local governments and organizations playing critical leadership roles. These entities have the experience of planning and conducting education campaigns that reflect local conditions and drivers on a variety of issues. Further, there are regional variances in acceptance of the Smart Grid messages, so structuring campaigns at this more regional level will result in better targeting of the right messages to end-users. The Department does have significant opportunity to support states and utilities in this activity. The National Action Plan on Demand Response outlines just this type of role for the Department.[1]
- The amount of on-going communication required by utilities for successful Smart Grid initiatives with participating end-users is significant, and it varies

[1] http://www.ferc.gov/legal/staff-reports/06-17-10-demand-response.pdf

by customer segment. This need to plan early and stay active with selected communication strategies is not always recognized or funded today as an essential element for success. Communication and education need to occur not only before equipment installation and program start-ups, but also after installation of meters and equipment to ensure end-users can maximize the value of the investment. On-going conversations and outreach that build trust and relationships are needed so utilities can reasonably expect the capabilities and acceptance of their Smart Grid investments will progress.

- The method by which utilities and regulators exchange information with end-users is also a critical element. With the variety of social media tools and the striking differences by which individual and end-user groups prefer to receive information, it is critical that as many tools and approaches be employed during outreach, including face-to-face interactions that complement on-line and traditional outreach strategies.
- The Department does have a significant and critical role to play supporting utilities and states as a resource to provide up to date information and lessons learned, particularly in the area of developing case studies and meta-analysis reports. The Department should focus on identifying key themes that are transferable among regions so states do not have to reinvent the wheel. Smart Grid should be recognized as but one of several key challenges utilities and state regulators are dealing with. Actual tactics to execute education and outreach should reflect this need to complement the broader offerings and strategies of the utilities and relevant state policies.
- In addition to working with utilities and state regulators, it is important for the Department to provide well designed packages of information to organizations that represent the interests of electric utility consumers. This outreach needs to be in both directions, where the Department informs these utilities and end-user organizations about current experiences with smart grid applications, and they provide the Department ongoing feedback about the concerns and implementation issues.
- Utility outreach and education plans can benefit from bringing key allies and constituent groups along to help them educate end users about the Smart Grid, e.g., environmental interest groups, consumer groups, faith-based organizations, etc. However, this has to be done very carefully, as constituent groups that might convince one subgroup of end users might well alienate another subgroup.
- A subset of the anti-smart meter protesters are less concerned with EMF and privacy and more concerned with collective investment. These small, but determined groups of citizens frame the discussion as one of liberty and freedom. That is, individuals should not be mandated to participate even if the “Collective Good” is enhanced. A key message in response to this concern can be that Smart Grid investments provide individual consumers with greater information and choices. The key to managing this resistance is dialogue and on-going communication.



- Market research is essential for individual utilities and states to plan and design Smart Grid programs. The Department can facilitate disseminating of market research data where transferability of data among regions is possible.
- The Department should seek to advance strategies that provide consumers greater tools and choices to take advantage of AMI deployments. A goal of the Department should be to accelerate the development of approaches that can automate responses of end-use devices to prices or grid conditions without materially impacting the ability of consumers accessing the services that such devices provide.

Health & Safety Issues

In the last several years, some of the objections to smart meter deployments have been based on concerns over alleged health effects. Specifically, consumers have expressed concerns regarding exposure to wireless radio frequency (RF) emissions arising from the use of smart meters in their homes. This concern may be related to similar concerns raised about cell phones and other electronic devices. Videos posted to YouTube, as well as stories posted on blogs, Twitter, Facebook, and other social media outlets have heightened consumer opposition to smart meters.

Concerns over RF emissions have led to legal challenges to smart meter programs. For example, in 2012, the Maine Supreme Judicial Court directed the Maine Public Utilities Commission to address health issues that had been raised by consumers in opposition to the smart meter deployment of Central Maine Power Company.[2] The

[2] *Friedman v. Public Utilities Commission,* Supreme Judicial Court of Maine, Docket No. PUC-11-532. Accessed at http://caselaw.findlaw.com/me-supreme-judicial-court/1606139.html.

Maine Commission had dismissed the portions of the consumers' complaints regarding the health effects of RF emissions, but allowed customers to opt out of the deployment in their homes if they paid an additional charge. The Court remanded the case back to the Commission for a full consideration of the health claims. Recently, the Maine Office of Public Advocate completed a further study on this issue and found no harmful impacts.[3]

Another recent safety issue involved fire hazards related to the installation of smart meters. On August 15, 2012, PECO Energy in Pennsylvania announced that it was suspending the installation of smart meters throughout its service territory after the company reported that 15 of the devices had overheated, including one that started a fire at a home. Cases of overheating smart meters were also reported in Maryland and Illinois. In all cases, the utilities preliminarily concluded that the events resulted from pre-existing electrical conditions at the site, rather than from defects in the meters themselves. In October 2012, after conducting an investigation and independent safety testing, PECO decided to swap out the meters previously installed by the original manufacturer and will resume deployment with another manufacturer.[4]

Due to these concerns and objections, several state commissions have authorized an "opt-out" provision for individual consumers who do not wish to have smart meters installed in their homes. In most of these states, consumers who opt out of the smart meter program must pay an upfront charge as well as higher monthly charges to offset some of the additional costs incurred by utilities serving customers using older technologies, including the cost of personnel and "truck rolls" to read their meters.

According to a number of industry reports, RF-related health concerns are unfounded. A California Council on Science and Technology (CCST) report determined that the levels of RF emissions from smart meter devices were lower than in many common household devices, including cell phones and microwave ovens. The report also noted that Federal Communications Commission (FCC) guidelines concerning RF emissions "provide a more than adequate margin of safety against known RF effects."[5]

The Vermont Department of Public Health measured meters installed by Green Mountain Power and found that they emitted no more than a small fraction of what

[3] http://media.kjonline.com/documents/smart+meter+report+0213.pdf

[4] Andrew Maykuth, "Peco to resume smart-meter installations with new manufacturer," Philadelphia Inquirer, October 11, 2012. Accessed at http://articles.philly.com/2012-10-11/news/34364508_1_sensus-meters-landis-gyr-ag-smart-meters.

[5] California Council on Science and Technology, *Health Impacts of Radio Frequency Exposure from Smart Meters*, April 2011. The report's appendix also lists a number of other studies related to RF emissions. The report can be accessed here: http://www.ccst.us/publications/2011/2011smart-final.pdf.

wireless phones emit, even at close proximity to the meter.[6] The Maine Center for Disease Control assembled a panel of leaders to review the literature on this subject and concluded "that studies to date give no consistent or convincing evidence of a causal relationship between RF exposure in the range of frequencies and power used by smart meters and adverse health effects." And in December 2012 Texas published a "Report on Health and Radio Frequency Electromagnetic Fields from Advanced Meters" concluding that there were no unusual impacts.[7]

Some utilities have worked closely with customers in an effort to alleviate their concerns about RF emissions from smart meters. Sacramento Municipal Utilities Commission (SMUD) in California recently installed smart meters in more than 600,000 homes and businesses, with approximately 2,500 customers initially refusing installation. A SMUD customer advocate spoke directly with each person opposed to smart meters installation, often allaying their concerns. A SMUD staff member visited those who remained opposed and provided RF testing for smart meters as well as other devices (cell phones, microwave ovens, etc.). Customers saw that smart meter RF emissions were the same or lower than these devices, and a majority agreed to installation.[8]

There is no question that these health and safety concerns have had an impact on consumer acceptance of smart meters in a number of states. Given that the evidence shows that radio frequency from smart grid devices in the home is not detrimental to health, the Department should cite the evidence gathered from Vermont Department of Health, CCST, SMUD and others to develop materials that effectively communicate the current scientific and industry evidence in support of these findings. They should provide such materials to each of the state commissions, all the utilities in the DOE SGIG and SGDP program, and other community based organizations which could help carry these messages.

Privacy & Cyber Security

The installation of smart meters has raised privacy and cyber security concerns as well. Traditionally, residential electric usage has been measured monthly and has been manually recorded by a utility meter reader solely for utility billing purposes. With smart meters, household usage can be recorded and reported on an hourly or

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[6] Vermont Department of Health, *Radio Frequency Radiation and Health: Smart Meters*, February 10, 2012, and *An Evaluation Of RadioFrequency Fields Produced By Smart Meters Deployed In Vermont*, January, 2013, http://publicservicedept.vermont.gov/sites/psd/files/Topics/Electric/Smart_Grid/Vermont%20DPS%20Smart%20Meter%20Measurement%20Report%20-%20Final.pdf

[7] http://www.puc.texas.gov/industry/electric/reports/smartmeter/SmartMeter RF EMF Health 12-14-2012.pdf

[8]. Silver Spring Networks Fact Sheet, January 2011, available at http://www.bge.com/learnshare/smartgrid/smartmeters/Documents/RFSafetyForReleaseJan2011WithCCST_v2.pdf

more frequent basis and this information may be provided to the utility through a wireless connection.

With respect to privacy, a small group of consumers have expressed concerns that the granularity and detail of smart meters could somehow be used to their detriment. While Americans are becoming increasingly accustomed to having less privacy in many aspects of their lives, there are legitimate concerns over utility data privacy that need to be addressed.

The Department has long recognized the importance of the privacy issue and its impact on the successful implementation of smart grid programs. In October, 2010, DOE issued a Report entitled, "Data Access and Privacy Issues Related to Smart Grid Technologies," in which it noted, "Smart Grid technologies can generate very detailed energy consumption information. Because of its detailed nature, such information should be accorded privacy protections – and the accord of these protections will do much to increase consumer acceptance of Smart Grid."[9]

Acknowledging the importance of these privacy concerns, the 2010 U.S. Department of Energy Report set forth a number of specific findings and principles regarding the appropriate use and protection of customer-specific energy-usage data (CEUD). One way to enhance consumer confidence in the use of smart grid technology is to ensure that the use of this data by any entity other than the utility for billing and operational purposes can be strictly controlled by the individual consumer. The 2010 U.S. Department Of Energy Report notes that "consumers should decide whether and for what purposes any third-party should be authorized to access or receive CEUD" and declares as its first guiding principle that "[u]tilities should not disclose CEUD to third parties unless a given consumer has consented to such disclosure affirmatively, through an opt-in process that reflects and records the consumer's informed consent."[10]

The Department and a variety of organizations across the country are also addressing cyber security and privacy protection by coordinating efforts with other national organizations such as National Institute of Standards (NIST), National Association of Regulatory Commissioners (NARUC) and North American Energy Standards Board (NAESB). While such guidance would not be binding on the states as they deal with specific smart grid applications, they will be useful in establishing "best practices" and may assist individual utilities and commissions as they deal with privacy issues in specific proceedings.

The Department should also use the data it has compiled from those utilities using ARRA monies to help finance smart grid installations to assist other utilities doing smart grid installations to implement measures to address any associated cyber security risks. Each utility accepting ARRA monies was required to develop and

[9] 2010 Data Access and Privacy Issues Related to Smart Grid Technologies Report, DOE, p.3
[10] 2010 Data Access and Privacy Issues Related to Smart Grid Technologies Report, DOE, p.11 & 15

submit to DOE a smart grid cyber security plan. The Department should review these plans and develop a set of cyber security best practices for other utilities to consider as they conduct smart grid installations. The Department should also publicize tools such as its Cyber Security Maturity Model, which utilities can use to address potential vulnerabilities that might arise as they install their smart meters.

Regulatory Considerations

It is incumbent upon regulators to insure that ratepayers obtain value and net benefits (some states have "no harm" as opposed to "net benefit" test) from utility infrastructure investments such as smart grid technology. Various legislative mandates and public policy initiatives aim to accelerate a variety of differentiated smart grid investments across the country. A common argument against deployment of these assets is that many of these technologies are not fully developed for practical applications, and to the extent that they are, they impose excessive costs on customers that cast a doubt on whether they are economically feasible for widespread implementation. These regulatory actions and how they are manifested publically should consider and reflect the significant influence they have on how the public perceives the value of SG investment.

As a regulatory body with the public policy charge to oversee utility implementation of smart grid, the public utility/service commission is generally, but not exclusively, focused on a robust and full understanding of ratepayer benefit prior to authorizing cost recovery. The regulator is generally required by statute to ensure that the utility has made its case that the investment is reasonable and prudent. One Smart Grid benefit to both the utility and its customers comes in the context of outages, when smart grid deployment enhances the identification of the affected customers and the speed it can be remedied. Examples of this type suggest that the regulator consider, for example, loss of load calculations and the value of rapid outage restoration in its diligent review.

Utilities, on the other hand, are incented to seek cost recovery for each dollar spent on smart grid investment. [11] Utilities often request surcharges, riders, or other pre-approved rate-recovery mechanisms prior to completion and/or deployment of a smart grid project.[12] Moreover, some regulated utilities may not see smart grid

[11] "How do you make money as an investor-owned Utility? **You put more assets into the ground**," says Jean Reaves Rollins, managing partner of the C Three Group in Atlanta, which developed the *Fortnightly 40* model and provides financial analysis for each year's report. "There's a huge rush to build electric transmission projects, and utilities are busy working on gas pipeline replacement programs, especially in older service areas. In the near term these investments hurt cash flow, but in the long term they increase the rate bases*."*(emphasis in original) *Public Utilities Fortnightly, September, 2012, p.23.*

[12]For example, see "Application of Baltimore Gas and Electric Company for Authorization to Deploy a Smart Grid Initiative and to Establish a Surcharge for the Recovery of Cost, Case No. 9208, Order No. 83410 (June 21, 2010)."

innovation or changed business models in a cost-of-service regulated environment as either immediate concerns or an imperative. Investments in technologies that support a more efficient electricity system are typically incremental. Obtaining cost recovery only after the investment is applied is seen as a barrier to technology innovation.

As society adopts and adapts to new technologies, regulatory bodies are going to have to be flexible to achieve the efficient, cost-effective, and reliable electricity system customers deserve. Regulators will be confronted with new business models, promising new technologies, new consumer demands, and environmental challenges. They must be prepared to consider new or different institutional arrangements that will benefit consumers and the way the electricity industry technologically transforms. The core issue is the need to bridge the gap between encouraging utilities to seek all cost-effective smart grid measures, while seeking cost recovery for program costs; and protecting the customer from imprudent investments, cost overruns, or unintended consequences of smart grid implementation.

Evaluation, Measurement, and Verification Frameworks for Smart Grid Investments

Evaluation, Measurement, and Verification (EM&V) is necessary to support important, sophisticated demand reduction programs initially available from smart grid. EM&V is one process by which the validity of benefits claims is established and provide reliable information to consumers who may be skeptical. These programs view controllable reduction of load as generation capacity in resource plans developed to support reliable grid operation.

The importance of EM&V may diminish as smart grid matures and if demand response migrates from participation in programs to normal market behavior in which consumers and the intelligent devices in their homes and businesses simply see and respond to changes in time-differentiated and dynamic prices.

Planners and operators should consider how demand will respond to time-differentiated and dynamic prices in their load forecasts. Some utilities and grid operators are already doing so. Dynamic pricing may reduce demand volatility. Time-differentiated and dynamic retail pricing are not resources. They are factors that could influence demand and appear on the demand side of the load – resource balance for planning and reliability purposes.

There are three potential reasons to pursue evaluation, measurement, and/or verification in different contexts —the regulatory challenge of understanding the incremental value of smart grid investments which may involve measurement and evaluation, the need to accurately predict the load reduction available from demand response programs treated as resources for purposes of maintaining grid reliability and require subsequent verification, and compensating those responsible for any load

reduction based on measurement of their demand compared to a program or tariff specified baseline.

Nationally, smart grid technologies are currently being added, in different ways, for different purposes, and at different times. Not only is each state or responsible federal administration developing its own approach to benefit measurement, but each must overcome varying structural and statutory impediments to achieving this goal, as well.[13]

Regulators will likely wish to consider issues encountered by multi-jurisdictional utilities and RTOs as well. Regulatory regimens in different jurisdictions will likely calculate and define savings individually and start with different baseline assumptions. Therefore, regulators will desire to be cognizant of conflicting public policies that could disproportionately burden one state or sector's ratepayers. Each regulator's development of an accurate, credible and appropriate evaluation, measurement, and/or verification frameworks for different purposes should address these issues already established as a bottom-up world, as will be developed below. Nationally accepted and standardized evaluation, measurement, and verification guides tailored to different regions and purposes would be beneficial tools for optimizing the overall smart grid.

EM&V are regional or bottom-up activities. The pervasive net-to-gross concept when applied to energy efficiency seeks to determine how much efficiency is driven by program incentives, and how much would have been achieved without the program simply because of the values of the consumers. These values vary dramatically by area. Private consultants already offer guides for evaluating smart grid investments as do EPRI and other organizations. Some additionally offer detailed program measurement guides. DOE and the Technical Advisory Panels advising the Department's ARRA programs have published guidance documents for evaluating impacts of smart grid investments. Further benefit could be derived from widespread publication and use of data and best practices recently collected by the DOE for ARRA project grants awarded to advance smart grid systems. This could fully leverage these multi-million dollar pilot programs.

The ARRA was a unique opportunity for smart grid seed investments, and in moving to a post-grant world of smart grid, it is imperative to develop a firm business case without further federal financing. The question becomes how to leverage the data received from the ARRA-sponsored pilot projects to create a credible template for projecting future smart grid costs and benefits.

[13]New York, for example, has privacy legislation which limits the ability of both regulators and utilities to track the benefits that smart grid advocates believe will be proven out by sound MV&A practices. The Tennessee Valley Authority, a federal corporation providing wholesale power, must perform M&V using metered data "owned by" its associated local power companies.

EM&V and the demand response programs supported by it are vital components in near-term recognition of benefits for smart grid. Additionally, DOE should support the identification and dissemination of best practices for the integration of predictable, automatic smart grid responses to price mechanisms into reliable load forecasts.

Rate Design & Regulatory Obstacles

As discussed earlier, wide-spread adoption of rate structures that take full advantage of Smart Grid technologies in some utilities is several years away. In approving new and expensive additions to rate base, regulators have an obligation to take into account the reaction of the consumer who will ultimately pay for these investments through their rates. Utilities must also ensure that the benefits outweigh the costs, particularly in the current economic environment. [14] Utilities should be expected to make prudent investment decisions including when to invest in SG technologies that could help flatten load shapes and improve asset utilization. These decisions may include considerations relating to the timing or conditions needed for pricing or rate structures that take advantage of SG investments.

Some of the public is increasingly aware, through social media and other sources, that there may be concerns with AMI meters. Whether or not there is a factual basis for any of Smart Grid related concerns, utilities, seeking to support positive policy should be prepared to address public concerns and perceptions.

Many rate-regulated states are only familiar with the flat-rate tariff. Given the deluge of potential data and opportunity presented by the proliferation of advanced meters, a general expectation around experimentation with varying rate structures, both promulgated by regulators, utilities and pulled by end use customers is expected. Dynamic pricing and time-of-use rates essentially begin with the intention to change the paradigm of how customers traditionally view the consumption of electricity. In the near term, the extent to which consumer behavior significantly evolves may largely depend on customer education, outreach, and coordination among all parties over the next few years. For example, New York considers time-of-use rates to be integral to achieving smart grid benefits at the homeowner level, but efficient demand response is now achieved almost exclusively from commercial and industrial ratepayers who also benefit from capacity payments through both the Independent System Operator (ISO) and individual utilities.

Regulators need to be aware how new rates could be treated in a rate case. For example, if a utility proposes a critical peak pricing rate, regulators should be aware of issues such as whether shareholders or ratepayers will bear the reduced revenue

[14] In New York, at least, regulated utilities have not demonstrated in the post-ARRA era (where costs were split between DOE grants and the relevant ratepayers) significant enthusiasm for smart grid programs at the residential meter level. At the transmission and distribution level, however, there is broad implementation which has demonstrated positive results.

from the estimated critical hours. Thus, the very business model by which utilities operate must be analyzed and identified. As natural gas becomes the fuel of choice for electrical generation, its low price and availability may make the original smart grid customer value propositions less evident—that with smart meters it can be more economical to do a load of laundry at 3 AM than at 3 PM. Policy makers can help lead a discussion about the value of more efficient pricing and gauge consumer feedback of what additional information is needed at the end-user level.

Case Study

There are a number of case studies being developed that will help everyone best understand the issues with consumer acceptance of the Smart Grid. One of the most interesting documented experiences to date is from the Sacramento Municipal Utility District (SMUD). The comprehensive approach taken by SMUD in dealing with the many issues and challenges discussed in the paper is impressive. A short summary of that utility's experience is provided in Appendix A.

Conclusions & Recommendations for Consumer Outreach and Education

The following recommendations are provided to the Department in the spirit of bringing the on-going best practices to utilities and regulators in an objective manner. As cited at the beginning of this paper, there are both near-term and longer-term challenges for utilities and regulators in facilitating consumer acceptance of the Smart Grid. In the near-term, the focus needs to be on enhancing outreach and communication strategies with end-use consumers to give them the best, objective information about Smart Grid. In the longer-term, as the integration of SG technologies and policies mature, utilities and regulators can focus on actualizing benefits such as real-time information and pricing.

- The Department should adopt a role of "Key Resource" in monitoring and assessing Smart Grid education and outreach since the Department does not directly touch the end-users of utilities. Case studies and lessons learned should be a focus to ensure transferable lessons from one region to another that can keep individual organizations from having to "reinvent the wheel." The Department can also play a strong role in supporting states, particularly as new models to oversee the electric utility industry are identified and implemented, e.g., with the continued growth and adoption of distributed generation technologies, how will traditional regulatory practices have to evolve and what will be the policies to compliment SG? A key principle should always be for the Department to develop and frame materials so they are objective and discuss both the benefits and challenges of SG investments.
- The Department should cultivate dialogue with key stakeholders at the national level to assist in developing "Key Resource" materials and disseminating those materials, e.g., National Association of Regulatory Utility Commissioners, Natural Resources Defense Council, National

Association of State Utility Advocates, Edison Electric Institute, National Rural Electric Cooperative Association, American Public Power Association, etc. The Department should seek to form partnerships with these groups to gain their support and involvement in disseminating materials and messages.

- Individual utilities and states may be aware of local and regional experiences, market characteristics, politics and drivers, but may lack the skills and experience needed to lead the design and implementation of effective education and outreach strategies. DOE should explore options to match utilities and states with the resources needed to produce the most effective education and outreach efforts. As discussed earlier, The National Action Plan on Demand Response offers a strategy that is applicable to Smart Grid consumer acceptance, e.g., the recommended "National Communications Program" would be a very complimentary tool.
- DOE should encourage utilities and states to emphasize messages that address the values and concerns of end-users. Campaigns that emphasize the benefits all end-users will realize through Smart Grid will help blunt potential criticism and opposition to the Smart Grid. Again, these materials need to be developed so they are objective and discuss benefits and the challenges associated with the SG.
- Comprehensive technical materials that address specific issues such as health and safety concerns, privacy, cyber-security and rate impact issues should be prepared by DOE, or highly credible and neutral third party organizations, and made available to individual utilities and states when these issues arise.
- There is a need for materials that address the near-term issues associated with educating and communicating the planning and installation of SG technologies. Further, the need for local utilities to have regular contact with Smart Grid participants must be identified and budgeted accordingly. And for The Department, the best practices of education and outreach will continue to evolve over time, so there must be an on-going effort to update materials and distribute the most up-to-date information through their distribution network.
- In keeping with its prior work on this issue, the Department should continue to acknowledge privacy concerns and to work with the industry, regulators, and consumers to develop principles and procedures that address those concerns. In this vein, the EAC understands that the Office of Electricity Delivery is undertaking an effort to develop a "Utility Voluntary Code of Conduct for Smart Grid Data Privacy" through a Department of Energy-facilitated stakeholder process. The EAC urges that as the Department conducts this effort, it take steps to ensure that utilities of all stripes and sizes and consumers are well-represented in the stakeholder process, to avoid a final product that does not in fact adequately address the issues that are being encountered "on the ground." The Department should also coordinate its efforts and seek to build upon, rather than reinvent, the significant work that has been completed by other national organizations addressing this issue, including NIST, NARUC, Smart Grid Interoperability Panel and NAESB.

- By working together, state and federal regulators, utilities, stakeholders, and the Department can identify strategies to bring about broad implementation of smart grid technology while insuring that the investments are prudent for the provision of safe, reliable, affordable and environmentally sustainable electricity. The customer and other beneficiaries must be protected from poor utility investment decisions. Benefits of prudent smart grid investments can be achieved for all beneficiaries whether in a conventionally retail-regulated state or in one which has retail competition.
- Outreach and education by the Department should also include model EM&V practices for the integration of predictable, automatic smart grid responses to price mechanisms into reliable load forecasts. To the extent possible, development of a generic template for EM&V should be developed in partnership with states and federal entities such as BPA and TVA.
- Additionally, the Department should support additional research (including evidence-based behavioral social science) from highly credible third-party sources unaffiliated with electric utilities or equipment manufacturers, and continue to monitor and collect accurate and complete information regarding the scientific and technical validity of the concerns, and then to disseminate that information to utilities, regulators and the general public in an unbiased manner. The Department should not downplay these concerns simply to achieve greater consumer acceptance of smart grid deployment; rather, the Department should obtain and disseminate the most accurate science-based information so that the public debate on these issues can be conducted in the most informed manner. In the longer term, such high quality information should do more to dispel health and safety concerns to the extent these concerns are unwarranted.

Appendix A

SMUD Case Study

With the assistance of a $127.5 million smart grid infrastructure grant from the U.S. Department of Energy, the Sacramento Municipal Utility District (SMUD) embarked in 2009 on a major effort to modernize its portion of the electric grid. The installation of more than 600,000 digital smart meters represented the first step toward implementation of a smart grid.

SMUD managed to deploy the meters with a customer satisfaction rate in the 90th percentile, thanks to extensive testing of the network and meters and an effective communications plan that dispelled most of the negative publicity surrounding the smart meter efforts of other utilities. Nonetheless, SMUD encountered a small but vocal group of customers who wanted no part of smart meters – and still don't. This report details the highs and lows of SMUD's smart meter rollout.

It's understandable why utilities are excited about smart meters.

Digital technology opens up a world of possibilities – the ability to track energy usage; respond to outages faster and more precisely; start and stop service remotely without having to send a meter reader to the site; integrate renewable resources into the grid more efficiently, and so on. Smart meters are the cornerstone of a smart grid that will change the way customers use electricity.

At the same time, it's important to realize that not all customers share a utility's excitement about smart meters.

SMUD encountered a small yet vocal and persistent group of customers who adamantly opposed the change. Some customers felt the new meters were an invasion of their privacy. Others expressed concern about radio frequencies. Several customers insisted that smart meters violate the Americans with Disabilities Act (ADA).

The initial number of SMUD customers who initially refused smart meters approached 2,500. SMUD appointed a customer-facing smart meter advocate, and this expert, along with the project manager, provided one-on-one contact with virtually every one of these customers. Some customers changed their minds when the SMUD Board of Directors instituted an "opt out" policy in which customers were given the option of paying an initial charge and a monthly fee if they declined smart meters.

Most of the concern about radio frequencies was alleviated when SMUD's customer advocate spoke to the customers personally. Customers were often satisfied to talk with someone who had a deep knowledge of the project, understood their concerns

and could answer their questions. Many customers just wanted to be heard. Once they spoke to a SMUD representative, they agreed to accept a smart meter.

For customers who remained adamant in their belief that smart meters were heavy RF polluters, SMUD staff visited their homes and businesses and provided on-the-spot RF testing not only for the smart meter but also for their cell phones, microwaves, wireless internet networks, etc. When customers saw first-hand that the smart meter gave off the same or lower RF than everyday household items, the vast majority consented to having a new meter installed.

Other customers needed convincing that SMUD wasn't playing "Big Brother" with their private personal information. SMUD worked to dispel this misunderstanding by showing customers exactly what information was transmitted and how. Extra effort was given to ensure customers that SMUD did not have the ability to know what TV shows were being watched in a customer's home. SMUD also emphasized why a utility had no interest in that type of information and made clear that its knowledge and interest was limited to hourly reads of total consumption.

Thanks to targeted communications and an intense focus on customer service, the number of customers refusing smart meters dropped steadily to 393 in September 2012. While this figure represented a minuscule percentage (.07 percent) of SMUD customers, the holdouts were persistent and weren't easily sold on the benefits or necessity of smart meters. There are dozens of anti-smart meter videos on You Tube that amplify the debate. SMUD staff is continuing to meet with the handful of customers who raised the issue of ADA compliancy.

Overall, however, SMUD's installation of more than 610,000 residential and commercial smart meters went better than anticipated. A handful of dissenters couldn't dent the overwhelming customer support SMUD received throughout one of the biggest projects in 66-year history.

While not every last customer will embrace meters, it's possible to avoid large speed bumps through extensive planning, outreach and communications – before, during, and after the actual roll-out.

Because once the meters are installed, the project isn't done. The key for utilities is to keep their eyes on the road ahead while continuing to keep the lines of communication open. It's working for SMUD and can work for other utilities. Just be aware that there will be customers who won't easily accede.

Laying the groundwork

The road to a successful rollout was pockmarked before SMUD switched out the first meter. It was clear that a steady hand would be needed on the wheel for what looked like a rough ride.

Media coverage of other smart meter rollouts, including that of PG&E's in Northern California, was unfavorable. SMUD would need to proceed very carefully to avoid a customer revolt.

Conversely, SMUD benefitted from the fact that PG&E went first. SMUD's smart meter team could learn from any of its neighboring utility's misfortunes and plan accordingly.

Being a publicly owned utility with a reputation for openness and customer service, SMUD started its own project from a strong place. Nevertheless, the goodwill developed over previous years and decades could be squandered quickly with a bumpy rollout.

Before a single meter was delivered to the loading dock in 2009, SMUD installed the network that reads the meters. The Landis+Gyr smart meters interacted with a mesh network developed by Silver Spring Networks. SMUD made sure that the network was working before installing a single smart meter.

This comprehensive testing of the network was a pivotal factor behind the project's ultimate success. Tests measured network capability as well as bill accuracy. This helped SMUD minimize estimated reads – a key point of contention for PG&E customers in Bakersfield.

SMUD began the actual roll-out during an 18-month trial period involving 80,000 customers representing a broad cross-section of SMUD's service territory: downtown Sacramento, with its dense arrangement of large buildings; the gently rolling hills of Folsom; and the wide-open, rural spaces of southeastern Sacramento County.

The first 80,000 meters were monitored closely to make sure that they were interacting accurately with the network. The project was then halted for three months to conduct further testing. Daily reads from testing showed accuracy of 99.5 percent, exceeding industry standards by a wide margin.

Once the meters and the network had passed these tests with flying colors, SMUD began full deployment. In 2011, SMUD was installing 65,000 meters each month. When the year ended, SMUD had activated more than 600,000 smart meters, and 92.7 percent of the customers surveyed said they were satisfied with how SMUD handled the rollout.

Keeping customers informed each step of the way

In early 2012, after full deployment, SMUD was awarded the "Smart Utility of the Year" award from Metering International, the leading publication on utility metering.

The award committee praised SMUD for a project that "stands out for its forward-thinking approach, including a wide range of appealing and informative materials developed for its customers, both residential and commercial, as well as its employees and contractors."

Companies often talk about the importance of quality customer service. The smart meter project offered an opportunity to put that talk to the ultimate test.

In 2009, SMUD conducted a sizable number of focus groups and community meetings. Customers said they expected four main things from their public utility:

- Rates that are stable and low
- Exceptional customer service
- New tools to manage energy usage
- More transparency about what they're paying for and why

Each of those expectations meshed well with SMUD's smart grid initiative. Those expectations guided SMUD's customer-friendly communication strategy and tactics from start to finish.

SMUD went to great lengths to make sure that customers were well informed about the smart meter transition. It was imperative that customers be fully informed beforehand, that their questions would be answered, and most important, be convinced that the new meters were accurate and reliable.

SMUD staff worked throughout the community to set up and conduct more than 180 smart meter presentations to local government groups, chambers of commerce, ethnic organizations, neighborhood associations, and dozens of other civic groups. The goal was to lay out the implementation plan, dispel any myths or rumors surrounding smart meters, and answer customer questions. This resulted in a much more informed community that understood the rationale and benefits of smart meters and the smart grid.

Additionally, 126 employee presentations were conducted to make sure that SMUD's work force understood the full scope of the project and could serve as ambassadors outside the workplace. All seven members of the SMUD Board of Directors were utilized in these outreach events, and 57 employees were trained to be "Smart Grid Advocates."

The Smart Grid Advocates were invaluable in removing much of the mystery out of the smart grid. SMUD made many of these advocates available to address any and all concerns throughout the project.

Also, by tracking calls and measuring customer satisfaction levels each month, SMUD was able to identify positive and negative trends immediately and respond quickly and effectively.

More conventionally, SMUD customers received letters, door-hangers, and a brochure with frequently asked questions about smart meters and the smart grid. Printed materials about smart meters were translated into five languages besides English. Customers were provided 14-day notices for installations with the option to schedule installation appointments within a one-hour window.

Smart meters were on the media's radar from the outset. This put SMUD's project under increased scrutiny. In general, SMUD's approach was to engage the media on more of a reactive than proactive level. The members of the smart meter team were media trained, enabling them to speak confidently to our customers through local news outlets. Media coverage was positive as a result. There were a few disgruntled customers, but not enough to sustain a story.

Bridge to the future

SMUD owes its very existence to the community it serves. Sacramento residents voted in 1923 to create their own community-owned utility because they wanted a voice – and a choice – in how they received their electricity.

Answering directly to the community, particularly on charged topics such as smart meters and the smart grid, requires a concerted, focused effort on the part of staff and elected board members. It's important to note that such an intensive effort involves a significant financial investment in staffing and other project costs.

Today, smart meters open a two-way communication with our customers that will benefit them for years and decades to come. They will have more choices than ever before, which means the communication efforts surrounding the smart meter project must be expanded in helping customers become more knowledgeable about the energy use.

This goes to the heart of SMUD's mission. The smart grid is closely aligned with SMUD's efforts to reduce its carbon footprint and develop a more sustainable energy supply. The smart grid is needed because SMUD needs to adapt to new technologies – consumer technologies, generating technologies, energy-efficient technologies.

Smart meters are a bridge to the future. Installing more than 600,000 of them is one of those jobs that are easier said than done – but it can be done, and done well.