ALLIANCE TO
SAVE ENERGY
Creating an Energy-Efficient World

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Smart Grid Request for Information: Addressing Policy and Logistical Challenges

Comments of the Alliance to Save Energy

The Alliance to Save Energy (the Alliance) thanks the Department of Energy for the opportunity to comment on broad issues of policy and logistical challenges faced in smart grid implementation.

The Alliance to Save Energy is a coalition of prominent business, government, environmental, and consumer leaders who promote the efficient use of energy worldwide to benefit consumers, the environment, economy, and national security. The Alliance is a nonprofit 501 (c) (3) organization.

Modernizing the electrical transmission and distribution network to create a smart grid, along with the incorporation of 'smart' meters and 'smart' appliances into consumers' homes and businesses, has become a major policy issue in recent years. The smart grid offers various potential benefits, including greater energy efficiency for end-users and in the grid. But while the potential for such benefits as grid stability, shifting peak loads, and eased meter reading, seem clear and large, the impact on overall energy use seems much less certain. Energy efficiency is often listed in the litany of benefits that smart grid and Advanced Metering Infrastructure (AMI) systems will offer, yet discussions and implementation of such systems often neglect energy efficiency and net demand reductions.

Smart grid has the *potential* to provide major opportunities for energy efficiency gains. On the upstream generation, transmission, and distribution side, greater situational awareness of grid conditions and real-time understanding of demand *may* allow for improved efficiency of grid operations and more optimal deployment of generation resources. Demand response activities *may* be able to improve grid efficiency as well. On the consumer side, greater awareness of energy use *may* allow consumers to better understand how they consume energy in their homes or businesses, allowing them to target effective energy saving measures. But if poorly executed without active attention to energy efficiency and net demand reductions, the potential energy saving benefits of smart grid systems could be missed.

The RFI seeks comment on five areas:

1. The best way to define the term "smart grid" for policymaking purposes;

2. The consumer-level benefits from, and challenges to, smart grid deployment;

3. The benefits and challenges associated with smart grid implementation on the "utility side" of the meter;

4. The ways in which policy makers at all levels of government can share experience and resources; and

5. The broader, economy-wide benefits and challenges associated with the smart grid.

While there are a vast array of issues facing effective build-out of smart grid systems, advanced metering infrastructure (AMI), and compatible consumer appliances, the Alliance is focusing the majority of its comments for this RFI on issues directly connected to realizing the energy efficiency potential of smart systems.

Thus these comments primarily focus on the second issue area: policy issues relevant to consumer-level benefits. However some issues are raised relevant to energy efficiency for utilities. The fifth issue area, broad economy-wide benefits, could be understood to encompass external benefits of the other areas. There is also overlap between some of these issue areas; for instance the interactions between utilities and consumers may become more numerous and complex with AMI providing a bridge between grid operators and consumers' home appliances. Whereas most consumers' interactions with utilities have consisted of monthly bills, there may soon be constant interaction between consumers and grid operators, even if much of it is automatic. As such, some issues discussed in a consumer context below are highly relevant to those on the "utility side" of the meter. Many externalities of issues discussed in a consumer or utility context could be seen as "broader, economy-wide benefits."

The Alliance's primary recommendations and comments discussed here include:

- Energy efficiency must be an integral goal of smart grid and AMI programs, from planning through to operation.

- Federal policy must ensure that consumers receive perceptible benefits from smart grid and AMI systems.

- Tax incentives and appliance standards have proven useful in encouraging improved energy efficiency in appliances; similar policies may prove fruitful for the encouragement of smart grid manufacture and consumer purchasing.

- Federal research and support for others' research activities is important to develop systems, particularly in the area of consumer interaction with data display systems, which could maximize consumer engagement with smart technologies and foster greater realization of the benefits touted for the smart grid.

- Policies fostering appropriate third-party engagement with consumer data could make the benefits of smart grid more accessible for consumers. But access issues, standards, and privacy questions will need to be addressed.

For the most part, these comments focus on energy efficiency alone, rather than peak-period demand reductions enabled through demand response capabilities of smart grid systems. While obvious benefits for peak period pricing and grid stability can be made possible with smart grid systems, the reductions in overall energy usage are not always so clear. While demand response can reduce overall energy usage, it does not always do so[1] – as when loads are shifted to off-peak periods such that total energy use is not decreased or may even be increased. There are also concerns that energy use could increase if baseline loads are gamed to inflate perceived demand response reductions for purposes of increasing compensation. Kilowatts are often the focus of smart grid debates, but kilowatt-hours, representing a more comprehensive perspective, must be given extensive consideration as well.

Consumer-level benefits and challenges

The energy-saving benefits for end-use consumers should be of particular interest in the development of policies to foster increased implementation of smart grid and AMI systems. Reduced consumer energy usage can be expected to directly reduce consumers' energy costs, providing a recognizable benefit. Given recent opposition to AMI programs by consumers (e.g., Southern California Edison's smart meter program) or on behalf of consumers (e.g., the Maryland Public Services Commission's initial rejection of Baltimore Gas & Electric's proposed smart meter program), buy-in by consumers and public utility commissions (PUCs) is critical for any real progress to be made in large-scale AMI build-outs. While indirect cost savings may be considerable from other elements of smart grid, the increased information and transparency on energy use enabled by a smart grid, and the resulting reduced costs on consumers' energy bills may rapidly foster goodwill towards smart grid and AMI programs.

Consumer Data Access

Smart meters should have the capacity to provide consumers with in-depth information about their use of electricity in their homes and businesses. But assuming these data are made available, how will consumers interact with it, and how can that interaction be turned into reduced energy use? Large data streams may be of interest to a small number of technically savvy consumers who have the time, interest, and knowledge to interpret data sets and graphs and adjust their own behavior accordingly, but the typical consumer will likely find this overwhelming, difficult, or simply of little interest. Systems will need to be designed to provide information which is easily understood and usable by a typical consumer if reduced energy usage is to result.

If systems and policies are in place to allow utilities and third-party energy management services to use data from smart meters and to program smart appliances or otherwise manage customers' energy use, such services could simplify use for consumers, increase benefits, and allow aggregation of savings for load management or demand response. However, some consumers may see 'subscribing' to an energy management service as an additional inconvenience if the benefits are not sufficiently great or obvious. How a consumer opts in or opts out of a program or parts of a program (and whether one must opt *in* or *out*) will also be of concern for both how effective a program can be and for consumer acceptance. Widespread participation by third-party entities is likely to require standardization of data and communication protocols, such as are being developed by the National Institute of Standards and Technology (NIST) under the Energy Independence and Security Act of 2007 (EISA).

Energy usage data has the potential to become a key part of helping consumers to reduce their energy usage. But as these data will most likely be gathered at an electrical meter owned and managed by the utility, the

[1] Charles Goldman, et al. *Coordination of Energy Efficiency and Demand Response*. Lawrence Berkeley National Laboratory. January 2010. 2.12 – 2.13.

question of who owns those data is a significant one. This is of great importance if third-party[2] energy management providers are to be able to assist consumers with programmed responses to grid events, real time pricing, or aggregation of demand response. Also of concern to utilities and third parties are potential liabilities that may arise from data transfer and management, including responsibilities for data accuracy, availability and timeliness, and authority to access and transfer such data. To make consumer efficiency benefits possible, policies should ensure that data are available to consumers in a readily usable form, that they can assign access to that data, and that all those who have access to the data are bound by privacy restrictions, and that there is equitable compensation for the costs of providing the data and now unfair liability for providing it. Legislation proposed in March 2010 by Representative Markey (H.R. 4860) and similar legislation by Senator Udall (S. 3487), the Electric Consumer Right to Know Act (e-KNOW Act), would require that utilities provide energy use data to consumers – particularly data generated by smart meters. Ensuring that such data are provided in a readily accessible manner via a standardized protocol would greatly help its use by both consumers and third-party entities that might manage that data for them. Without policies to ensure ease of access and use of this data, utilities may see little benefit in managing the administrative overhead needed to provide access to such a massive collection of data. However, as discussed below, even if consumers are given control of their energy data, most will not be able to benefit unless doing so is simple enough for a casual user. Regulation or legislation may be necessary to ensure that consumers are able to assign data access to third parties.

Historically, the relation between utilities and their customers has been an almost entirely bilateral one; customers draw electricity from their distribution company and the distribution company bills them for it. The possibility of introducing one or more third parties into this relationship challenges traditional utility-consumer relationships. It may be challenging in some instances to make utilities willing to open the traditional model to outside entities. On the other hand, attempts to foster retail competition between electricity suppliers and between natural gas suppliers have largely failed to encourage large numbers of consumers to look to change the traditional relationship or respond to competitors seeking their business. Similar problems may be faced with attempts to engage large numbers of consumers in smart grid programs.

Privacy issues are also significant. Load profiles of appliances and other electrical loads could be identified in a smart meter’s readings, and smart appliances could inform utilities (or a third party with access to the data) when they were operating. Some might find this sort of data collection overly intrusive, and there could be some potential for abuse. Data security could also be an issue. Resolutions of these privacy and consumer issues would likely involve collaborations among various federal agencies, including, for example, the Federal Communications Commission and Consumer Products Safety Commission, among others.

Data Display

With the availability of smart meters, the opportunity exists to provide consumers with a valuable tool for reducing energy usage: access to near-real-time data on energy use assists home or business owners seeking ways to reduce energy usage. Yet few AMI programs make these data available to consumers at intervals significantly better than monthly meter readings of non-smart meters offered. Additionally, merely making

[2] Where building tenants are involved, this could become a four-way interaction. Tenant-occupied space accounts for about half of the total non-governmental commercial floor space. Very little attention has gone to understanding the incentive structure or the best means to provide demand response-related information to commercial tenants, including issues of improved energy sub-metering of these spaces.

such information available to consumers does not automatically result in energy savings.[3] As noted above, the casual user must be able to make sense of any data provided and any system designed to display that data. Consumers must also want to actually view that data in the first place; requiring one to log on to an online system to view energy use data is unlikely to regularly attract the majority of users. Stand-alone data display devices or screens, such as could be mounted on a wall or set on a counter, incur additional costs that may discourage either utilities or consumers; issues of cost assignment may need to be addressed and energy savings potential well known. Even more useful may be systems that can analyze the data and give consumers specific and actionable information on energy uses and what they can do about them.

This also assumes that consumers will be given ready access to such data in a timely manner and with a useful data interval. Rep. Markey's e-KNOW Act would require fifteen minute intervals; Senator Udall's version of the bill would do the same, but not require it to be made available for 24 hours. Google PowerMeter, an online interface used by several utilities to present data gathered from AMI systems, displays a minimum of ten-minute intervals. While such intervals are useful for getting a sense of general levels of energy use (e.g. 'Energy use went way up shortly after coming home from work'), it does not provide sufficient data granularity to see effects of turning on an appliance or fully disaggregate or analyze energy uses, or provide sufficient timeliness to allow real-time reactions to increases in energy use. Home energy monitors can offer near-real time energy use data (e.g. one second intervals on a two second delay with an Energy, Inc. TED5000 device), but this level of data granularity does not seem forthcoming from utility AMI programs.

Many of these issues were considered by the Office of Science and Technology Policy in an RFI on consumer interface with the smart grid, conducted in February and March of 2010.

Smart Appliances

Communication between smart grid-enabled equipment[4] and utilities could allow for better management of energy demand to enhance the efficiency, economy, and reliability of the electric grid.

Encouraging consumers to purchase appliances that are able to interact with smart meters and communicate with equipment on the grid may be difficult unless those consumers recognize benefits to themselves. Presently, for many appliances, Energy Star labels are often only available on premium appliance models; the first smart grid-enabled appliances are likely to remain premium models as well. As such, it is critical to identify clear consumer benefits from smart appliances, and ways to convince consumers of the benefits or ways to convince the manufacturers to include smart capability as a standard feature.

Both consumers and manufacturers may need incentives to encourage use and availability of smart grid-enabled appliances. However, while utilities would be the logical providers of such incentives as the benefits accrue to the grid, manufacturers are likely to need nationwide policies that are consistent in the national markets for appliances. They are unlikely to manufacture an appliance in response to one utility's criteria or incentives. ENERGY STAR label criteria could be used to encourage smart capabilities in labeled products.

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[3] Darby, Sarah. 'Smart Metering: What Potential for Householder Engagement?' *Building Research and Information*. Volume 38, Issue 5. September 2010. 442 - 457.

[4] These could include typical appliances (refrigerators, air conditioners, water heaters, etc.); electric and plug-in hybrid vehicles; and smart building components like lighting. But in theory any electrical or gas-powered device could be designed to use smart grid communications protocols to reduce consumption or behave in some other beneficial manner.

A bill in the United States Senate, the Implementation of National Consensus Appliance Agreements Act (S. 3925), would direct the EPA and DOE to consider whether smart grid and demand response features ought to receive credit against energy savings in ENERGY STAR criteria. The use of tax credits to encourage energy efficiency improvements and manufacture of energy-efficient appliances (in, for example, sections 25C and 45M of the tax code, respectively) is well established and generally considered to be successful. Indeed, the section 48C Advanced Energy Manufacturing Tax Credit, as created by the American Recovery and Reinvestment Act, can be applied to investments in smart grid technology manufacture. Sections 25C and 45M both expire at the end of 2010. Future versions of these tax credits could include smart grid capabilities in efficient appliances. Eventually, incorporating smart grid capabilities into appliance standards could ensure effective and consistent capabilities in all models of a given type of appliance.

Communications standards (and hardware standards where appropriate), such as are being developed by NIST and associated organizations, are important to ensuring that manufacturers can market the same products nation-wide and that consumers can move appliances when relocating, while retaining functionality with local smart grid and AMI systems across a range of utilities. Lack of nation-wide compatibility would discourage both manufacturers and consumers. “Plug and play” capability for appliances across various utility smart grid and AMI systems is similarly important to maintain ease of use.

Utility-side benefits and challenges

Smart grid capabilities across the transmission and distribution (T&D) network can allow T&D systems to operate more efficiently, reducing line losses and reducing excess generation needed to ensure grid stability. Smart grid systems would allow improved awareness of conditions on the transmission and distribution system in real time. This would allow the grid to be operated with tighter margins of error – thus more efficiently.[5] The Electric Power Research Institute (EPRI) estimates that reductions in line loss attributable to voltage regulation could save from 3.5 to 28 billion kWh in 2030.[6] Smart grid capabilities may help utilities meet existing Federal Energy Regulatory Commission (FERC) and North American Electric Reliability Corporation (NERC) regulations regarding grid stability. As such cost savings directly accrue to utilities, efficiency gains in the T&D system should provide a significant incentive to the utilities and their regulators.

Smart grid technologies could ease widespread adoption of electric vehicles (EV) by preventing potential stresses to the electric grid and may even help enhance grid operations by providing load stabilization and leveling services. Automatic charging of vehicles at off-peak times could prevent peak load problems that could be created by post-rush hour mass plugging-in. Without smart charging, 220V (or higher voltage) charging stations could strain local distribution systems if vehicles were charged on-peak. But according to one estimate, existing off-peak capacity could accommodate 73% market penetration of plug-in hybrid and battery-electric vehicles.[7] In addition, unrelated demand response activities enabled by smart grid could mitigate peak loads, freeing existing generation and transmission capacity for residual EV charging during peak periods. Batteries in parked smart-grid enabled vehicles could also be used as an energy source for grid regulation, with small amounts of energy pulled back from the batteries as needed to balance local fluctuations in demand or compensate for smaller-scale supply problems. Tax credits for electric vehicles are

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[5] For further discussion, see R.G. Pratt, et al. *The Smart Grid: An Estimation of the Energy and CO_2 Benefits*. Pacific Northwest National Laboratory. January 2010. 3.27 – 3.29.

[6] Electric Power Research Institute. *The Green Grid*. 2008. 5-3.

[7] McKinsey. *Unlocking Energy Efficiency in the US Economy*. July 2009.

seen as important for building a market for these new technologies. In addition, it is important that their owners see the right incentives to make sure their vehicles are stabilizing rather than crippling the electrical grid.

Transmission planning is normally based on a set of assumptions and projections that assume an end to many policies after their current iteration, often based on Energy Information Administration (EIA) models. For example, the New England Independent System Operator does not model energy efficiency past the existing forward capacity market bidding, effectively assuming that all programmatic energy efficiency policies cease after three years. State-level programs are also not included in load forecasting. This disadvantages such demand-side activities as smart grid-based demand response and energy efficiency programs that are likely to reduce expected loads beyond the three-year planning horizon. It advantages supply-side generation resources, effectively acting as a spur to unnecessary capacity in the planning process. It also may result in the construction of transmission infrastructure that would be unnecessary had supply-side non-wires solutions been given greater consideration. Were the EIA to make projections based on a realistic assessment of future energy saving programs like smart grid policies, even if conservatively assessed, excess investment in generation-side resources could be avoided and demand-side programs, such as could be enabled by smart grids, would be able to compete on a more level playing field.

Other Issues

In working to expand smart grid infrastructure through government policy, it is worth considering what the goals are that smart grid systems are intended to achieve, and if those same goals might be more easily (or cheaply) met with simpler technology implementation. Many of the benefits of smart systems can be achieved with non-smart, or at least non- or less-interconnected systems. For example, Maryland customers of Pepco can participate in a demand response program, ‘Energy Wise Rewards’ that cycles participants’ air conditioning on and off during peak periods via radio signal to either a special programmable thermostat or a receiver attached directly to the external air conditioning unit; no smart meter or smart grid is required. A refrigerator could have a clock that simply tells it not to defrost until 2am when grid loads are low. Energy monitors and sensors can provide consumers with accurate energy use data at much more granular intervals than that which smart meters provide, as discussed earlier. Advanced home automation systems can realize many of the automation benefits of smart grid without a smart meter or direct utility communication connection.

Conclusions

While much of the policymaking that will determine the face of the smart grid in the coming years will be determined by public utility commissions, grid operation organizations, and state-level government bodies, the federal government is also in a position to create incentives and regulations that encourage greater production and adoption of smart grid-capable technologies. Tax incentives, informational labels, and equipment standards, along with utility programs, may provide the “carrots and sticks” to bring such technologies into consumer appliances.

More broadly, support for key areas of technology development and deployment could accelerate key areas that could help consumers reap energy savings. For example, beyond the largely-committed ARRA funding, the Advanced Research Projects Agency – Energy can support many smart grid-related technology endeavors; the Clean Energy Deployment Administration proposed in legislation including the House-passed American Clean Energy and Security Act (H.R. 2454) could provide valuable financing and credit support for such efforts. Support for research into consumers' interactions with data display systems could be of particularly great benefit in understanding how consumers can realize the greatest personal benefits from smart grid technologies; the National Science Foundation could play an important role here.

The Federal government is also in a unique position to be an "implementer of first-resort." Widespread implementation of smart grid and AMI systems in Federal facilities would provide a boost to the technologies and encourage quicker economies of scale that would benefit the general consumer base.

With the possible exception of some T&D upgrades, consumer opinion will be the ultimate determinant of smart grid's success. Consumers must recognize that smart grid systems and the advanced meters attached to their homes and businesses provide real value, reflected in whatever costs they are required to pay on their utility bills. While grid stability, security, and T&D efficiency are real benefits to all those connected to the grid, the connection to the bills to pay for smart grid may not be obvious. As such, the Federal government should seek to ensure that consumers are able to see useful information from the smart grid and realize real energy savings that bring down their energy bills; helping to reduce their demand through energy efficiency is the most effective way to achieve this.

Thank you for the opportunity to comment on this important issue.

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