ASHRAE

Technology for a Better Environment

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Michael Li
U.S. Department of Energy
Office of Electricity Delivery and Energy Reliability
1000 Independence Avenue, SW
Room 8H033
Washington, DC 20585

Regarding "Smart Grid RFI: Addressing Policy and Logistical Challenges"

Dear Mr. Li:

As a leader in developing and maintaining premier consensus-based energy standards for commercial and other buildings, ASHRAE will be an essential partner as the Department proceeds with creating the Smart Grid.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc. (ASHRAE), founded in 1894, is an international organization of over 50,000 members. ASHRAE fulfills its mission of advancing heating, ventilation, air conditioning and refrigeration to serve humanity and promote a sustainable world through research, standards writing, publishing and continuing education.

Buildings account for 72 percent of all electrical energy consumption (37 percent residential, 36 percent commercial)[i] and 58 percent of all natural gas consumption nationwide. Because buildings consume more electricity and natural gas than any other sector, buildings will play a central role in the evolution of the Smart Grid, and will become active participants, as energy storage centers, dispersed renewable energy micro-generators, and electrical vehicle charging stations.

As the Department continues collecting information on the policy and logistical challenges that confront Smart Grid implementation, we offer the following comments on the above referenced RFI.

"Smart Grid" Definition

ASHRAE supports the Smart Grid definition found in Title XIII of the Energy Independence and Security Act of 2007 (EISA) and notes that it is sufficiently broad to encourage technical innovation, while providing a framework to guide Smart Grid development.

Rationale: The evolution from the current grid where electricity is simply generated and consumed, to a more dynamic and interactive "Smart Grid" presents a multitude of potential benefits to consumers, utilities, businesses, and society at large. By communicating with end-users in real-time, the future grid will decrease total energy consumption, reduce peak demand, and improve the integration of central station and distributed renewable sources of energy into the grid.

The Smart Grid also will improve energy security by protecting the privacy of consumers and automatically rerouting power, essentially "self-healing" by resisting and responding to emergency scenarios, such as attacks and natural disasters. The Smart Grid also will benefit the economy through real-time pricing, potentially lowering costs to end-users.

Realizing these benefits requires a common definition of "Smart Grid." The long march to the future grid will require significant coordination among all stakeholders. This coordination will be greatly aided by establishing a common language.

Standardization of Information Exchange and Data Management

ASHRAE/NEMA Standard 201P Facility Smart Grid Information Model can provide a basis for common information exchange between control systems and end-use devices found in single- and multi-family homes, commercial and institutional buildings, and industrial facilities that is independent of the communication protocol in use.

ASHRAE strongly believes that BACnet A Data Communication Protocol for Building Automation and Control Networks (ANSI/ASHRAE Standard 135-2008), and BACnet technologies should play a leading role in the evolution and implementation of the Smart Grid.

Rationale: Managing data in the Smart Grid will be a major issue. Data is generated at each stage of energy generation and consumption. Robust support for the data produced during the interplay of the on- and off-site generation of renewable and nonrenewable energy, its transmission, storage, and consumption will be required to capture efficiencies, and prevent data loss and unnecessary duplication of effort.

BACnet is a well-established data communication protocol for building automation and control networks, and has been communicating on standard IP networks for more than ten years. BACnet currently possesses energy management and load control capabilities, and is a natural fit for integration into the Smart Grid. Recently BACnet's Utility Integration Working Group was re-chartered as the Smart Grid Working Group. The Working Group focuses on enabling buildings to act as full participants in the Smart Grid – receiving price and event signals from grid operations, as well as requests for resource status, and responding to grid signals with control actions to appropriately manage energy.

Support Research and Development

We encourage DOE and other federal agencies to continue and increase support for research and development of the Smart Grid. ASHRAE also supports private/public joint research and demonstration programs and deployment partnerships that will help to advance the Smart Grid. Research and demonstration projects that document the economic benefits of changing customer behavior also should be encouraged.

Rationale: Implementing the Smart Grid is a complex project that affects all market sectors. Research and development are needed to more accurately assess its benefits and costs and to anticipate its requirements. Demonstration projects will help speed adoption of both technology and practices.

Customer Incentives and Technology

Research on balancing integrated load, generation, and thermal storage with response to a local price signal and toward stable grid operation should be actively funded. Research and demonstration projects that document the economic benefits of changing customer behavior will also speed adoption of both technology and practices. Voluntary participation driven by economic incentives is more likely to succeed than mandatory programs.

Federal policy should emphasize energy efficiency over the Smart Grid in the commercial/industrial and residential markets.

Rationale: Based on numerous pilot programs that have taken place in the United States, it is clear that customers understand and will respond to pricing options if the on-peak off-peak differential makes it worthwhile to do so. There are studies from Georgia, California, Maryland, Washington DC, and many other parts of the U.S. that show that customers do respond, and that customers with automated systems respond to an even greater degree.

To avoid possible resistance to the Smart Grid, it should be emphasized that customer responses should not be forced; it will happen if pricing signals are adequate and response mechanisms are present. Commercial and industrial customers generally are not willing to cede control of equipment and building systems to an external energy services company. Likewise, as technology enables more appliances in the home to respond to grid signals, residential customers will likely also resist direct load control approaches.

There will be situations where some consumers will not be interested in using Smart Grid technologies. For example, some/many consumers will not replace appliances they recently purchased in order to have an appliance that is “Smart Grid ready”.

There is a link between energy efficiency, net zero energy buildings, and a Smart Grid. Policies that encourage energy efficiency can substantially reduce the need for new grid capacity. However, efficiency improvements lower the incentive to respond to price or demand response signals. For example, if a consumer replaces a 20 year-old refrigerator that uses about 1,000 kWh per year with a refrigerator that uses 450 kWh per year, the average and peak demand available for demand response will be much less. As another example, a customer with an old 3-ton air conditioner rated at 9 EER will use about 4 kW at EER test conditions (95 degrees outside ambient air). If the customer purchases a new air conditioner that is rated at 13 EER, the new peak demand will be 2.77 kW - a 31.25 percent reduction in peak demand, which also means a 31.25 percent reduction in potential demand response.

Federal policy should emphasize energy efficiency over the Smart Grid in the commercial/industrial and residential markets. Buildings operate on a very slow time scale in terms of the length of life of equipment/appliances and the life of the structure itself. As demonstrated above, there is generally not enough economic benefit in the Smart Grid to justify upgrading useful equipment and buildings to a more Smart Grid-ready model. However, there often is enough value, with the right price signal, to drive the investment in controls and energy management tools to provide better monitoring and energy management of existing equipment. We would also note that standards in the home domain are still developing and merit a slow roll-out of technology in the home space.

For residential power management, we note the progress in Europe with the Dutch ECN Powermatcher platform that has successfully used thermal storage attached to heat pumps to shift load off-peak, and an auction-based local power arbitration approach to integrate electric vehicles such that they charge off-peak. The Pacific Northwest National Laboratory is working on a similar approach to residential power management. Research along the lines of balancing integrated load, generation, and thermal storage with response to a local price signal and toward stable grid operation should be actively funded.

Part of designing for energy efficiency is installing sensors and controls to allow monitoring building performance over time. Equipment performance degrades and devices malfunction. Sensors can detect that degradation. Sensors and controls also enable fine-grained energy management such that one room can have fresh air and heat as needed for a large meeting, while the room next door has no lighting, and no heating and ventilation because it is unoccupied. If we design buildings for that kind of energy efficiency and healthy operation, then we also have buildings that are optimally prepared to respond to grid events and changes in electricity price.

For large customers, even small price changes can provide an economic incentive. The experience of the Georgia Institute of Technology in responding to small 24-hour advanced notice price signals is an example[ii]. In some cases capital investments to install thermal storage systems are needed to take advantage of dynamic pricing. Policies that make this capital investment easier would encourage adoption. Research and demonstration projects that document the economic benefits of changing customer behavior will also speed adoption of both technology and practices.

Education Campaign

We encourage DOE to coordinate with stakeholder groups on an ongoing, multi-year educational campaign at the local, state, and national levels to help prepare society for the changes that will accompany the gradual shift to a Smart Grid.

Rationale: Because the evolution to a Smart Grid will be complex and far-reaching, affecting each and every person in the United States, an intense educational effort will be needed to accommodate this long-term shift. Many consumer, industry, utility, governmental, and other stakeholder groups will be essential partners in achieving this objective.

Costs of Developing the Smart Grid

The costs of investments in developing the Smart Grid should be paid for by end-users as they are incurred. Likewise, benefits of this development should be realized as customers respond to price signals.

Rationale: Energy regulation should not encourage an energy market where utilities receive greater profit from selling power and from increasing the rate base by investing in generation and distribution equipment rather than from investing in efficiency. Rather, utilities must be incentivized to save energy and to empower customers to save money. However, it is acknowledged that the utility-customer relationship is necessarily different for large vs. small customers. As we slowly move toward real-time pricing, utilities and the government will have to encourage the small, less-energy-aware customer to invest in energy efficiency and the Smart Grid through tax incentives, appliance rebates, and an ESCO-like system of investments where the utility assumes the risk and handles installation and management.

Social Norms and habit Formation

Previous RFIs on the Smart Grid have addressed data access, storage, and privacy issues. However, we would like to re-affirm that ASHRAE strongly supports the consumer's right to privacy.

Rationale: ASHRAE believes that federal and state energy policymakers should know nothing about individual customer's energy usage and habits compared to their neighbor's. This information may be supplied in aggregate, but individual customer energy usage should be considered private. The possibility that individual customer information could be disclosed would be very detrimental to customer participation in Smart Grid activities and hamper the benefits that could otherwise be gained.

Align and Coordinate Development of Net Zero Energy Buildings and the Smart Grid

ASHRAE encourages DOE to support industry and governmental activities to align and coordinate the goals and progress toward net zero energy buildings with the development of the Smart Grid to help ensure that net zero energy buildings are integrated into the Smart Grid.

Rationale: This will help reduce duplication of efforts and increase stakeholder communication and participation in the development of these highly related activities. This coordination will be especially important, because as noted above under "Customer Incentives and Technology", as energy efficiencies increase, and end-users' draw on the grid decreases, their activities contribute less to peak demand, and their incentive to react to price or demand response signals may also decrease. While larger customers may be somewhat more likely to respond to marginal price and demand signals, this is a paradox that must be avoided through careful thought and analysis. Coordinating Smart Grid and net zero energy building efforts and ensuring continuing communication will provide opportunities to sort through and solve these complex technical and policy issues.

Summary

ASHRAE hopes that these comments in response to the RFI on the policy and logistical challenges that confront Smart Grid implementation will assist the Department in developing solutions to these challenges.

We look forward to responding to any questions or comments the Department may have on ASHRAE's RFI response.

Personal regards,

Lynn G. Bellenger
LGB/gfc

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[i] U.S. Department of Energy. *2009 Buildings Energy Data Book*. http://buildingsdatabook.eren.doe.gov/.
[ii] Alexander, Donald, Cornelius Ejimofor, and David Holmberg. "BACnet® at Georgia Tech." ASHRAE Journal Nov. 2007. http://www.nist.gov/manuscript-publication-search.cfm?pub_id=861044.