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Smart Grid Development: The Wal-Mart Perspective

The nation's electricity grid infrastructure is undergoing a transformation. Known as the development of a Smart Grid, all of the technological advancements and innovations in two-way digital communications and control technology are being brought to bear on all aspects of grid operations -- from the largest generator to the household appliance. The Smart Grid promises to empower customers such as Wal-Mart to truly manage their energy needs and lower costs for customers. Making good policy decisions during the Smart Grid's development stage is critical to fulfill that promise.

Smart Grid Background

The primary impetus for the Smart Grid is the *Energy Independence and Security Act of 2007* (EISA) and Congress made available $4.5 billion for Smart Grid deployment in the American Reinvestment and Recovery Act, the so-called stimulus legislation. While there is no formal definition of Smart Grid, EISA states that the policy of the United States is to modernize the nation's electricity transmission and distribution systems to meet certain goals, among which are:

- Increased use of digital information and control technology to improve the reliability, security, and efficiency of the grid.
- Dynamic optimization of the grid. The most efficient decisions about energy consumption and supply will result from two-way communication of information among smart devices, grid infrastructure, and effective price signals.
- Developing or integrating into the grid:
    - Distributed resources, including renewables. This includes "behind-the-meter" distributed generation, such as combined heat and power systems and on-site photovoltaic generators.
    - Demand response based on prices and demand side and energy efficiency resources, such as advanced heating and cooling equipment, energy efficient appliances and lighting, and equipment to shift load to off-peak times.
    - "Smart" technologies (real-time, automated, interactive technologies that optimize the physical operation of appliances and consumer devices) for metering, communications concerning grid operations and status, and distribution automation.
    - "Smart" appliances and consumer devices, such as remotely controlled air conditioners.
    - Advanced electricity storage and peak-shaving technologies, including plug-in electric and hybrid electric vehicles, and thermal storage air conditioning.
    - Standards for communication and interoperability of appliances and equipment connected to the electric grid.
- Providing consumers with timely information and control options for making decisions about equipment use based on electricity prices.
- Identifying and lowering barriers to adoption of smart grid technologies, practices, and services.

All of this leads to a future grid that is more reliable, more efficient, and puts customers in charge of their energy choices. Through improved sensing and control equipment, the grid will be able to avoid blackouts by instantly detecting potential disturbances and then taking self-correcting measures. An improved ability to integrate renewable and distributed generation resources will mean lower costs for all consumers. Digital communications and interactive technologies that give customers the ability to see price signals and to respond to them by programming appliances to cycle on and off according to prices or taking other actions that decrease consumption will give customers control over their energy bills.

Smart Grid Benefits

As work continues in developing standards and protocols, writing software, and deploying equipment, it is clear that the Smart Grid holds the potential to bring substantial efficiency and reliability benefits to all grid users and to the nation. From a customer's perspective, the Smart Grid is especially promising because it will empower us to be a fully engaged participant in energy markets with a vastly increased ability to manage our energy use, control our energy costs, and earn revenue as a competitive supplier of resources in electricity markets. Advanced metering allows us to pinpoint energy trouble spots in our facilities, and two-way digital communication and control devices will allow Wal-Mart to learn quickly of demand response opportunities in the market and to take advantage of those opportunities. All of this means more reliability and lower costs to us, and lower prices to our customers so they may save money and live better.

Policy Considerations

Developing the Smart Grid will not be a linear process. Writing standards and protocols and deploying equipment are now occurring, and will continue to occur, simultaneously across different aspects of the grid. Policy makers will be confronted with many important decisions along the way. Wal-Mart suggests that the following policy considerations be kept in mind.

Security should be a key priority in the development of the Smart Grid. Cybersecurity is a significant concern because the Smart Grid will enable, and depend on, a substantial increase in two-way communications among millions of devices across utility systems. Accordingly, cybersecurity protections must be incorporated into Smart Grid standards.

Smart Grid deployments by utilities or ISOs can be accomplished through a collaborative process and preceded by pilot programs. This will help ensure deployments are done in the most cost effective way and will best address issues such as two-way communications, metering options, customer rates and dynamic pricing.

Customers must be allowed to participate fully in all collaborative processes. The grid will not be as smart or as useful as possible unless all users are allowed a voice in its development. The Smart Grid must accommodate the needs of customers. And, in fairness, customers deserve a voice. The Smart Grid will be developed with money from customers, either directly through the

rates paid by consumers to utilities or indirectly through the taxes paid by consumers that finance federal grants and loan guarantees authorized by the recent stimulus act.
Cost recovery of Smart Grid equipment through utility rates should have sufficient ratepayer protections. For example, utilities should be required to make a persuasive showing that would address the expected benefits and costs of deployments before their costs are allowed into rates, especially during the early stages of Smart Grid development. In one case, a utility purchased AMI equipment prior to standards being enacted in its state. When standards were enacted, the company's meters did not meet the standards and the utility is seeking a $93 million reimbursement from its ratepayers.

Customers must be provided with clear and understandable prices. Deploying time-of-use or real-time pricing and identifying the separate components of prices (such as generation and wires) are important. If customers do not see this information, the true potential benefits of a Smart Grid will not be realized.

Customers should be given the option to provide demand response and other services directly to the markets administered by the grid operator. For many functions, customers such as Wal-Mart have the knowledge to act on their own behalf and may not need the services of a third-party demand response provider in all circumstances. In addition, the Smart Grid's two-way digital communication will enable customers a vastly improved method to deal directly with the market operator.

Customers should be allowed flexibility and choice as to metering options. Metering data is critically important to the customer's ability to monitor and control the energy usage of specific equipment, evaluate energy efficiency, and communicate with marketing entities for demand response programs and energy procurement. Metering data with sufficient granularity must be available to customers in time to use with the customer's automation and network systems. Metering standards can be developed in collaborative processes. Plus, a wide selection of meters manufactured by different metering companies in a market based economy leads to the creation of green jobs.

Standards are needed for communication between customer systems and system operators. For example, Wal-Mart's metering system monitors the system operator's energy management system to detect whether a demand response event has been called. A standard communication format from system operators would greatly enhance operations for customers and meter system providers operating across multiple systems. AMI vendor-specific or proprietary communication protocols will not improve on the current situation. A nationwide standard communication format should be developed.

Metering and communication standards should be developed with open architecture. Some customers, like Wal-Mart, are in the best position to know what metering and communication equipment best serves their needs. Interface software and equipment should be developed by the suppliers with the best ideas, and customers should have flexibility to choose among them. Consider the proliferation of iPhone applications. Thousands of applications developed by many innovative software writers are successfully integrated into the iPhone platform. The same can happen with Smart Grid applications.

Customers should retain all of the environmental attributes associated with any metering or equipment purchased by customers that result in energy efficiency improvement or carbon emission reduction. Customers should retain such attributes regardless of whether they have taken advantage of utility sponsored programs. To do otherwise would deprive customers of a return on their investment in equipment. In addition to being a matter of fairness, such a policy will foster efficiency and innovation by incenting customers to purchase the best equipment to meet their needs instead of simply using whatever equipment the local utility provides.

Dispatchable load programs or other means of "direct" load control should be deployed solely by customer choice. Curtailment or interruption of circuits can affect lighting, heating, air conditioning and other equipment that may impose safety and commercial risks. For example, loss of lighting could present safety or personal injury issues and an unexpected loss of refrigeration can compromise product quality and result in a loss of sales.

Most organized regional electricity markets provide a solid and efficient platform for Smart Grid benefits. Because of their clear location-specific real-time price signals, emerging demand and renewable resources, and innovative technologies, a majority of these markets are structured to better deliver the benefits of Smart Grid to customers and incent customers to participate.

Customers should have a larger role in participating in ancillary service markets. Grid devices and programs will give customers enhanced communications and increased ability to adjust their demand in response to price signals. As a result, customers will be able to participate to a greater extent in the current ancillary service markets, which could result in higher quality services than those currently available. Increased customer participation in ancillary markets not only will increase efficiency and lower costs for everyone, but will also provide the revenue needed by customers to pay for their own advanced meters, allowing more customer flexibility in the marketplace.

Summary

Wal-Mart looks forward to interaction with the Smart Grid, to the benefits of the innovation and state of the art technology likely to emerge from Smart Grid development, and to the thousands of new green jobs created by the Smart Grid in a market-driven economy. The Smart Grid will help Wal-Mart manage its overhead and thereby help our customers save money and live better.