Demand Side Management? Fitting the Pieces Together

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The movement toward the development and optimization of the smart grid has been challenged by the usability of its point of promotion: the feasibility of assimilating innovative technologies to better the utility, its customers and the environment.

A smart grid design must be cohesive, incorporating all facets of the infrastructure. To have a fully interoperable system, the grid's individual components must be well-understood. Demand side management (DSM) has warranted tremendous attention in this regard. A major contributing factor is that DSM has many facets that may go unrecognized. Is DSM a technology, an education issue, a pricing incentive or a process?

It's all of these. The U.S. Department of Energy (DOE) refers to DSM as "actions taken on the customer's side of the meter to change the amount or timing of energy consumption. Utility DSM programs offer a variety of measures that can reduce energy consumption and consumer energy expenses."

While the DOE defines DSM well, it would be impossible to discuss the driving factors and complexities of it in two sentences. Depending upon the perception of the environment in question, the DSM structure may be deployed many ways. This selection can have dramatic differences on the functionality and participation in the system.

When DSM is viewed from a technology standpoint, cutting-edge electronics and automation become the focus of the system. Recent DSM structures have been related to upgrading thermostats, electric heaters and pool pumps because these devices can help mediate consumption for high-energy systems. These regulation tools can communicate with electric meters and adjust energy uses. This has great potential in lowering consumption once it is deemed to have reached a particular threshold.

The automation of the technology is available, but its practical issues must be addressed. Utilities must be able to account for the many implementation points and effects of their corresponding locations. Communication paths to various control devices have significant differentials from home to home. When a home meter is 5 to 10 feet within a thermostat, one can assume a stable, reliable and consistent communication link will result. Distancing the meter and thermostat might result in communication interferences attributed to transmission losses over distance, absorption into the material construction in the walls, etc.

Implementing DSM requires education on behalf of utilities and their customers. Utilities must use their resources to design solutions. For example, communication interference resulting from distancing meters and thermostats must be addressed to accomplish efficient systems. In this case, who is responsible for designing the solution? How will applicable parties be educated on tackling similar issues? To optimally provide equipment structure and maintenance, utilities must consult radio frequency experts, network managers and installation staff. Time, materials and network instability are agitators that must be handled adequately. Methods to address these internal issues must be communicated to all appropriate utility personnel to support DSM implementation.

Customers should be educated on DSM applicability and how it can modify their energy use. Utilities must inform customers on the extent to which the utilities may modify customers' usage. To have a successful DSM application, utilities also must consider customer participation incentives. Customers generally are uninformed on strategies to prevent energy loss and utility stress. For example, thermal storage units function in the DSM process of load shifting. This method reduces peak load and eliminates significant potential demand charges that might apply.

A fairly obvious way to shift behavior and processes is to provide a pricing incentive for utilities and their customers. Regarding thermal storage, utilities must concur that purchasing the required equipment will be cost-effective. There will be significant savings for the energy being purchased at night to offset the equipment cost. For some utilities, increasing customer participation in DSM is as easy as providing rebates for energy-efficient appliances and lighting. For others, DSM can be structured via rate options.

Utilities are targeting three pricing options to change homeowners' energy consumption: time of use (TOU), critical peak and dynamic pricing. In a TOU pricing model, a utility provides a standard rate for energy consumption depending on the time of day. This allows consumers to routinely adjust their behaviors to comply with market demands.

Pacific Gas and Electric Co. describes critical-peak pricing as beneficial to its customers by "providing lower energy rates on non-CPP event days in exchange for higher rates on CPP event days."

In essence, critical-peak pricing creates high prices when the utility is capacity-restricted in an effort to reduce or shift energy usage. Because consumers are informed ahead of time, users can plan to modify energy usage to save money. Unlike TOU pricing, critical-peak pricing can vary substantially. Echelon Corp. credits dynamic pricing as one of the most valuable benefits an AMI system can offer customers.

According to Echelon, dynamic pricing provides customers with "time-differentiated rate and price signals that provide incentives for customers to modify their electricity use and behavior to their and the utility's benefit."

To have any of these structures be successful, appropriate hardware, software, client targeting, public relations, etc., must be explored and applied adequately.

To have a successful, reliable DSM program, utilities must approach the technology implementation with a process. Regarding technological applications, utilities must decide how many devices and structures it will need.

More important, the process in which these elements fit together must be researched, defined and applied. Each piece of the DSM program must have specific targets that are measurable, obtainable and supported by the utility. The program's goals and benefits must be presented carefully to the affected parties.

One also must consider the impact of economics and communication that fit into DSM decision-making. As the DSM decision-making process unfolds, it is critical to understand the cost benefits. Incorporating better communication and pricing incentives into the process of DSM applications can cause a significant reduction in demand.

Utilities should incorporate communication strategies into their implementation processes to promote positive participation. For each DSM program design, clear goals and objectives must be established with definitive costs for the initial implementation and ongoing support.

A DSM program can go from light bulbs to plug-in electric vehicles, to solar to pricing, to electric meter remote disconnects and beyond. DSM will touch every piece of the smart grid world. With every use of DSM, the technology, education, pricing and process must be defined and addressed to build an optimum solution.

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