Demand Response: The Lurking Danger (and the Simple, Industry-Wide Solution)

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By Brian Seal

One of the most ambitious objectives regarding the development of a Smart Grid is the widespread integration of residential load with the operation of the grid. Although residential devices are difficult to reach because they are numerous and widely distributed, they are of interest because of their correlation with peak load. Historically, residential load management has been dominated by direct load control with disconnect switches being used to cut power to devices. The Smart Grid vision improves on this with the idea of communication-connected devices that can respond to grid conditions in ways that maximize savings while minimizing inconvenience to the consumer.

Clearly, communicating with residential devices will require standards at many levels. Several NIST priority action plans are working to establish **standards** for the information to be exchanged, the protocols for transferring the information, and the technologies that may be used to establish connectivity. The work of OpenSG (requirements) and the Zigbee Alliance in developing the Smart Energy Profile (SEP) provides an excellent foundation for information exchange requirements. The North American Energy Standards Board (NAESB), the Association of Home Appliance Manufacturers (AHAM), the ClimateTalk Alliance and others have also made significant contributions to standards for demand response.

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The issue is particularly complex at the lower layers. There are many different architectures

(energy management console, meter as a gateway, direct communication to devices) and many corresponding **technologies** (AMI, FM radio, Internet, paging, powerline carrier, Wimax, cellular, etc.) that are used for communicating utility information to homes. Each architecture and technology has certain advantages, and is used to satisfy the needs of a specific demand response program in a way that is best suited to local conditions.

This diversity is beneficial, since we are still learning how to do residential **demand response** and we do not yet know which approaches will work reliably, securely, and most of all, with consumer acceptance. As advanced as we'd like to imagine ourselves, the truth is that we are still many years away from broadband in every home or ubiquitous AMI. And so the central question is this: How can off-the-shelf products be made today that can provide demand response opportunity for all consumers, wherever they may live or move, and not become obsolete, even over 20 or 30 years?

One way to answer this question is by defining an open standard for a modular interface, rather than prescribing a fixed communication technology. EPRI has been working with a collaborative group of appliance manufacturers, communication providers, and utilities to study this concept, to prototype devices, and to perform interoperability testing. The industry group USNAP Alliance is also focused on this idea and has made significant contributions.

The general concept is that residential devices, or energy management consoles that control them, could be designed with a standardized connector or socket into which the homeowner could plug a communication module of their choosing—electing to connect to a local utility's system, or to some other energy managing entity. With this approach, the socket interface can serve as a point of demarcation between the consumer's asset (an energy management console or end device) and the utility's asset (a communication system). It frees the consumer from the uncertainty and risk of communication systems and load management programs, and at the same time frees the utility to design and evolve their communication architecture as needed. Like the PCMCIA slot on a laptop computer, a standard demand response socket on residential devices would allow them to work with any **communication technology**, even those not yet invented, and would enhance free-market competition.

The EPRI study, which is open to anyone who would like to participate, has resulted in a draft specification for such an interface. This specification is currently being used by participants to develop a range of prototype devices and communication modules that will be interchangeable. Interoperability will be evaluated using these prototypes in actual installations and the feedback will be used to refine the specification. The work is being coordinated with NIST efforts in this area and will be a contribution to appropriate standards activities in the future.

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