

## Platform Longevity: Avoiding Stranded Assets

When considering how a load control device fits into a broader smart grid vision, thermostats offer a broader range of capabilities than switches. Though both technologies will feature two-way device diagnostics for utility-focused M&V analytics, the switch lacks features that enable customer interaction, which is central to the smart grid value proposition to customers and regulators.

Currently, the smart grid marketplace is extremely fragmented, with participants ranging from start-up, single-technology firms to Fortune 100 companies. Though identifying the right device for a demand response program can be difficult, a carefully-planned thermostat can serve as an excellent entry point for a utility. The thermostat controls the largest energy load in the house, immediately capturing the greatest savings opportunity. It provides an initial smart grid exposure at a manageable investment level that can evolve into the centerpiece of a whole-house strategy as the market matures.

Utilities seeking a platform with the greatest future flexibility should consider the following elements:

### Pricing signals

Many new pricing strategies are on utilities' near-term planning horizons, such as time-of-use pricing, critical peak pricing and critical peak rebates. In any of these strategies, a thermostat should indicate which pricing tier is active, or whether the customer is currently experiencing peak pricing. This can be accomplished in many ways, including screen indicators, lights, or messaging. The thermostat may even recognize pricing signals and take action based upon a profile pre-programmed by the customer or the utility.

### Communication protocols

Communication protocols are rapidly evolving. A flexible platform should accommodate over-the-air upgrades or physical upgrades to a new communication protocol, if necessary, for a pre-determined cost to the utility. In the near term, thermostats will also accommodate multiple communication modules in the same body. This will allow utilities to leverage the strengths of multiple communication protocols, such as ZigBee® for rapid communications from the meter, and WiFi backhaul via an in-home network for more data-intensive exchanges.

### Customer messaging

A smart thermostat should provide an appealing messaging interface for customer communication. With options such as

dedicated message screens, message mailboxes and billing screens, utilities could provide weather updates, billing statements, or many other types of information. A billing screen can indicate to the customer how their bill compares to the last billing period, or even provide water, gas, and other utility bills, in addition to electric. Some thermostats flash to attract attention, and may even request that a customer acknowledge the message, and send a confirmation back to the utility.

### Mobile applications/remote programming

The ability to receive commands over the air will enable greater interactivity as software applications become more sophisticated, providing significant customer and utility benefits. A centralized point for customer control of multiple loads – whether via a mobile platform, an in-home dashboard or a cloud-based application – is an important addition. The thermostat should tie into these centralized applications, and provide the option to include other load-control devices, such as strip and plug loads, and pool pump or hot water heater switches.

In this way, a near-term, well-thought-out investment in a simple thermostat-based load-control system can provide a long-term platform that will benefit both utilities and customers.

### Conclusion

While expectations for demand response programs are high, these expectations are warranted. The technology exists to deliver reliable load control in a way that increases customer satisfaction and engagement, with similar cost and greater reliability as compared to a load control switch. In order to ensure program success, utilities must choose a technology vendor with a robust and flexible offering, a long-term roadmap, and a platform that can grow along with program expectations. This will enable an investment in a load-control program to provide real benefits to the utility and the end consumer – both now and in the future.

### Find Out More

With 30 years of experience in the utility industry, Honeywell is the largest implementer of residential demand response programs in North America. These programs utilize a variety of technologies, from the newest home energy managers and thermostats to air conditioner, pool pump and hot water heater switches. The company is also a major provider of commercial automated demand response, energy efficiency and water-conservation solutions to utilities. For more information, go to [www.honeywell.com/utility](http://www.honeywell.com/utility)

# Structuring a Residential Demand Response Program for the Future

## Key Technology Considerations: Evaluating Load Control Devices

Utilities implementing demand response programs face a complex set of decisions. Demand response programs are significant investments which will likely be in place for years, and must meet many goals. To establish a successful program, utilities must consider several important elements, including cost, reliability, platform longevity and customer satisfaction.

A successful demand response program can take many forms, but must possess a number of standard characteristics. A demand response program should always reduce load reliably, for less than the cost of avoided peak generation. The advent of the smart grid, however, means program expectations are changing. Public utility commissions (PUCs), communities, utility stakeholders and utility customers now expect increased end-user engagement, often including clearly demonstrable benefits to the end user. This entails strong integration between the utility and their customers, and frequently prompts utilities to select tools that help homeowners manage energy consumption – both meeting PUC mandates and increasing customer satisfaction.

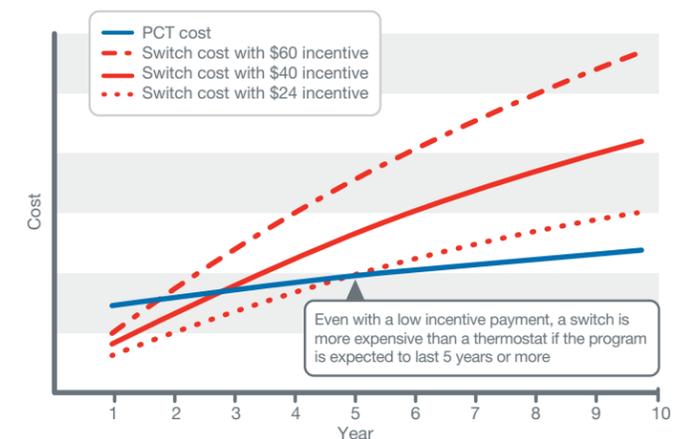
Although expectations placed upon residential demand response technology are evolving, device longevity requirements have not significantly changed. Today's utility-deployed technologies may need to remain relevant for 10 to 20 years, and be adapted into a future smart grid framework. As a result, technology selection can have a long-lasting impact on the success of a demand response program. Though there are many options in the marketplace today, the most widely deployed and economical technologies continue to be the programmable communicating thermostat (PCT) and the load control switch. Both offer key benefits based on program goals and needs, and require careful examination based on several key criteria.

### Cost: Are PCTs More Economical Than Switches?

Cost is the most frequently cited reason for choosing a switch instead of a PCT for a demand response program. However, a very simple analysis shows that the cost of the two technologies may not be as different as perceived. A comparison of the devices' notable differences – i.e., product cost and installation requirements – reveals that a switch is the more economical choice in the first year of a demand response program.

However, demand response programs are not a one-year load management solution for utilities. Based on total cost of ownership, as shown in the chart below, a thermostat is usually the more economical choice, even considering a conservative 10-year program life span with minimal incentive payments.

### Demand Response – Relative Device Costs (NPV)



Analysis available upon request. Includes estimated device maintenance costs. Excludes marketing and program management costs.

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The most significant cost in a switch-based program is ongoing incentive payments. Incentive payments are a complex subject and can involve multiple strategies for increasing customer penetration. Regardless, switches are almost always combined with an incentive payment because the technology provides no intrinsic benefit to the customer. For determining the type of incentive, a rough rule of thumb is to offer a bill credit of at least \$10 per month with a typical cycling season lasting four months. When a utility targets high customer penetration goals, the incentive may need to be significantly higher.

In contrast, a thermostat with no additional incentive can achieve targeted penetration rates between 10 and 20 percent on average. For instance, a Midwest utility surveyed its customers in 2004 and learned that 24 percent would participate in a demand response program if given a digital programmable thermostat with no additional incentive. Only 21 percent of those surveyed indicated they would join a switch program with an annual incentive – and 58 percent felt the incentive would have to exceed \$50 per year to obtain their participation.

### Marketing and Installation Practices

Marketing and installation practices are also critical elements of demand response programs, especially for overcoming technology-specific challenges. For example, in apartment owner/renter populations, building owners see no benefit in a switch because incentive payments typically go directly to the renter. The building owner simply views the switch as a potential maintenance issue. A recent field audit found that switches on multi-dwelling units were disconnected at a much higher rate than residential installations.

In contrast, property managers and owners often welcome thermostats, because the technology adds value to their property, provides significant maintenance benefits and removes a potential source of mercury from the residence. When a demand response program has to drive deeper or more cost-effective penetration, this can be a very effective target population, as apartments provide access to dozens or hundreds of participants at a time.

Thermostats can also provide year-round economic benefits to utilities. For example, for southern utilities, where heat pumps and electric furnaces are more common, winter peaks can be significant. By lowering the electric furnace setpoint of a critical population by a few degrees in a carefully targeted manner, a utility can manage a portion of its winter system load. And, in some states where gas furnaces are more prevalent, utilities that supply electricity and gas can count gas savings toward their energy-efficiency goals.

<sup>1</sup> Customer study; East Coast, April 2011. <sup>2</sup> Ibid.

### Reliability: Long-Term Program Effectiveness

A thermostat-based demand response program can provide longer-lasting load curtailment than a switch-based program, because the devices are less likely to be removed or bypassed. Frequently, if a utility customer has an HVAC contractor service an air conditioner, the technician may remove or disable a switch to avoid a potential callback. Neither the customer nor the contractor is likely to notify the utility, and it may take a site visit for the utility to determine the status of the switch.

In 2002, two studies on switches deployed in the northeastern United States for more than five years found that 40 percent did not operate properly due to malfunctioning, removal, or disconnection of switches. This is an even greater problem in the commercial space. A 2011 study revealed that 70 percent of commercial switches were disconnected.<sup>1</sup> Commercial end-users are acutely aware of their customers' comfort and are more likely to call for service in times of discomfort. Because commercial facilities generally use rooftop HVAC units, switches on commercial units are more difficult for technicians to service and audit.

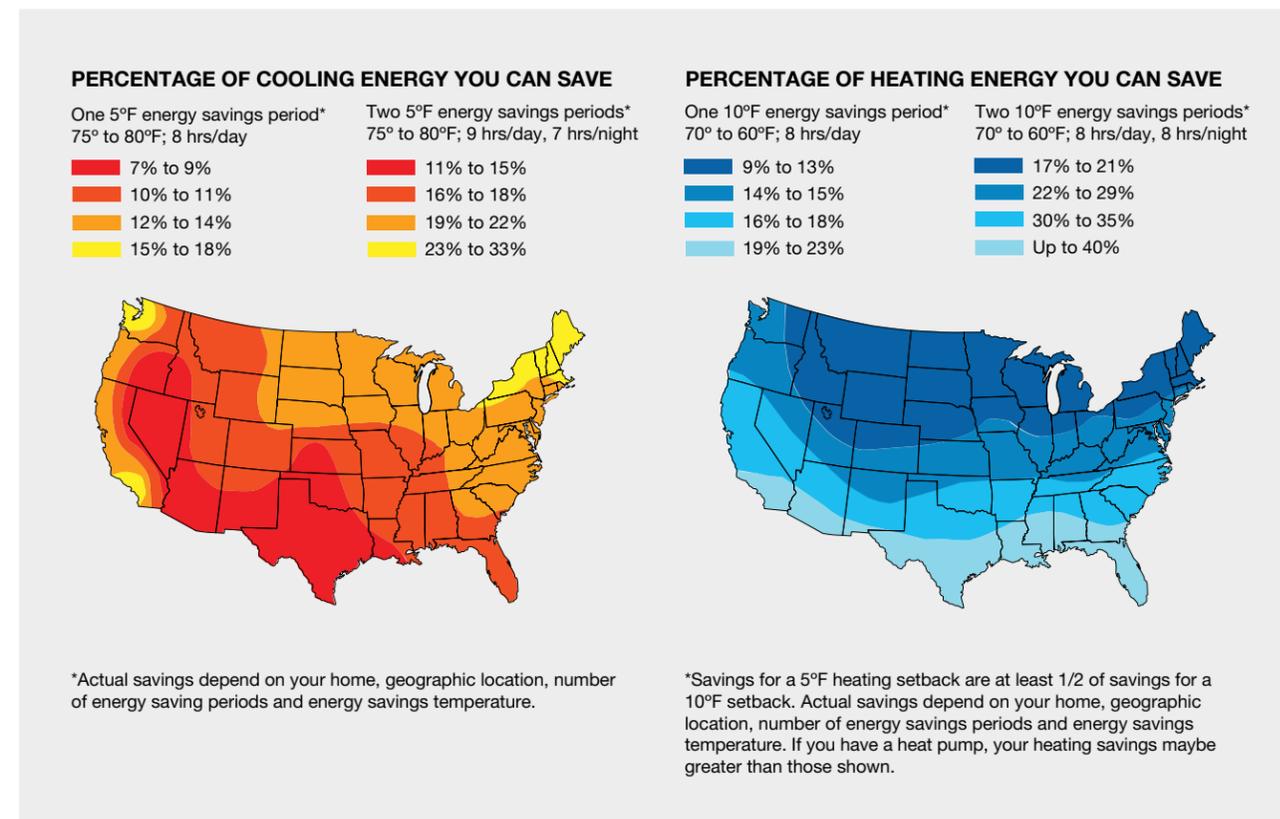
Thermostats, however, are an integral part of HVAC systems and as a result are rarely removed. Although thermostat failure is unlikely, most utilities elect to replace thermostats at no charge when necessary. While the customer perceives this as a benefit, it also benefits the utility by preventing the degradation of the demand response resource. By offering this service, the utility reduces the need for field checks, and can be viewed as a partner to the customer in their home.

Thermostat design should also be carefully considered. For instance, requiring customers to opt-out of events via the Web or a call-in number is typically a design that allows maximum customer satisfaction with minimum load degradation. Because load control events typically go unperceived by the customer, a poorly-designed opt-out option, or one that is too easy to access, may jeopardize load reduction and provide little, if any, customer satisfaction.

### Customer Satisfaction: Giving the Consumer an Active Role

When given the choice and an equal incentive, over 79 percent of customers select a thermostat instead of a switch for a demand response program<sup>2</sup>. While a switch will shed load, a thermostat provides ancillary benefits to both the customer and utility. An advanced, programmable thermostat provides comfort, convenience, and energy savings to the consumer, who can tailor a program to meet his or her personal schedule and temperature/savings preferences.

Certain premium thermostats that are easy to use and offer advanced features have been shown to double the likelihood that customers will actually program the thermostat, which can lead to even deeper benefits. Based on a large-scale program study done in the eastern United States, 40 percent of thermostats removed from customer homes were found to be non-programmable. In some instances, the utility can count those replacements toward its efficiency goals. Replacing non-programmable thermostats can generate savings on a customer's cooling bills, and also promote increased efficiency during the heating season. The rate of savings varies by region, as shown in the diagrams below<sup>3</sup>.



Remote and mobile platforms are also important customer benefits. Remote thermostat programming capabilities are particularly compelling for commercial building owners who can manage multiple sites from a single Web portal. Mobile applications are exciting for homeowners who can control energy use with smart phones and other devices. While available in new demand response thermostats, these applications will continue to become more sophisticated.

To better inform and involve customers – and ultimately deliver a successful demand response program – utilities should have constructive conversations about energy use with their customers. A well-planned in-home installation takes about an hour and provides an opportunity to kick

off the program in person with the customer. The visit can include setting expectations, programming the thermostat online and at the unit, conducting a walk-through assessment of key equipment, and gaining important customer feedback. And because customers who participate in demand response programs are more likely to participate in other programs, utilities can also use the time to cross-sell other initiatives such as appliance, HVAC, or rate-based programs, or to conduct important customer satisfaction research. Especially for utilities that conduct automated meter reading, there are few other reasons to visit a customer's premises. Maximizing the value of this in-home visit can provide an excellent customer touch point.

<sup>3</sup> A combination of Honeywell internal studies: Reducing energy consumption during the cooling season; Energy savings of high performance thermostats in residential electric heating systems; control systems providing energy savings with single and multizone hydronic heating; and ASHRAE Journal papers: Computer predictions and test verification of cooling energy savings with thermostat setup; Heat pump setback; Field test of energy savings with thermostat setback.