

Appendix G: Information Technologies For Demand Response

Quantifying the Benefits of Dynamic Pricing In the Mass Market

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APPENDIX G: INFORMATION TECHNOLOGIES FOR DEMAND RESPONSE

Potential information “technologies” for demand response are: in-home displays, detailed usage analysis, and prepayment metering. In-home displays can convey information to customers about their consumption and the price of electricity in real time, as well as provide messages from their electric utility. By making customers aware of the amount of electricity they are consuming and the relationship to their electricity bill, they may be more likely to conserve. There are a variety of in-home displays. Current experience with these devices and their impacts on customer electricity consumption are limited to experimental pilots. Below, we describe some of the specific in-home display technologies as well as other methods for providing information on electricity usage.

Real-time Feedback Monitors

Real-time feedback monitors that display information about current electricity consumption, the price of electricity, and the cumulative amount that has been spent on electricity can be installed in the home. A specific type of real-time feedback monitor is the PowerCost Monitor by Blue Line Innovations. This device also allows customers to view an estimate of the carbon dioxide emissions that are being produced as a result of their electricity consumption. The device can be self-installed on the electric meter by the customer. Information is wirelessly transmitted to the monitor, which can be installed anywhere in the house. The PowerCost Monitor can be purchased and installed by individual customers for under \$150.

The effectiveness of the PowerCost Monitor was recently tested in a pilot by Hydro One in Ontario, Canada.¹ In the study, 500 of Hydro One’s customers were equipped with the Power Cost Monitor and data on the customers’ electricity usage was collected over a period of two and one-half years. The results of the pilot suggested that, on average, customers with the devices reduced electricity consumption by 6.5 percent (at a high level of statistical significance). This reduction was sustained over time and did not reduce over the duration of the pilot. Within the sample, customers with non-electric space heating were found to reduce consumption at a much higher level than those with electric space heating. This suggests that, for the customers with electric space heating, the feedback from the electric heating load would need to be separated from other end-uses in order to effectively encourage conservation for these customers. Overall, customers expressed a high level of satisfaction with the device, with over 60 percent indicating that the device was useful in helping to conserve energy. These results were achieved in the absence of any accompanying incentives or price schemes.

A 2004 study by Primen, Inc., identified several other devices that provide similar information, such as the Cent-a-Meter, EUM-2000, Energy Detective, and Greenwire Energy Monitor.² Prices for the devices range from \$50 to \$225, and most of these devices require additional installation costs, since installation cannot be performed by the customer.

¹ Hydro One, “The Impact of Real-Time Feedback on Residential Electricity Consumption: The Hydro One Pilot,” March 2006.

² Primen, Inc., “California Information Display Pilot Technology Assessment, Final Report,” December 21, 2004.

The Energy Orb

A feedback device that has been tested in California is the energy orb (also known as the “glowing orb” or “ambient orb”), produced by Ambient Technologies. The energy orb is a small glass ball that changes colors as conditions on the electricity grid change. Prior to being used in this context in California, the orb was used as a tool for monitoring financial portfolios. In the stock market context, the orb could be set so that when certain stock prices were increasing, it would turn a mild blue color. As the stock prices began to drop, the color changed to red, encouraging orb owners to more actively manage their portfolios.

In California, the impacts of the energy orb were tested through the California Information Display Pilot (IDP).³ In this study, the energy orb was used in conjunction with CPP rates.⁴ The orb changed colors as the customer’s electricity rate increased, and flashed for four hours prior to a critical event. A total of 62 customers participated in the orb experiment. Results of the study suggest that residential customers reduced demand during the critical event due to the orb, and also during the four-hour warning period. Based on a survey of residential customers, 70 percent indicated that the orb led to a change in their behavior. A consistent demand impact was not detected for commercial customers. This study was limited by the small sample size and the results were not statistically significant. Only two customers indicated that they would be willing to pay over \$25 for the orb.

The energy orb can also be used to provide customers with signals for emergency demand reductions.

Detailed Monthly Usage and Bill Analysis

A straightforward way to provide customers with information about their electricity use is through a monthly analysis of their energy consumption. In addition to measuring the energy orb impacts, the California IDP also measured the impact of a monthly newsletter that provided customers with a detailed breakdown of their usage patterns for the previous month, along with suggestions for reducing consumption to save money on their electricity bills. The newsletter used bill determinants and customer survey information to set benchmarks based on the prior month’s use and to compare individual customers’ usage to that of other customers in a “report card” format. The participating customers were equipped with AMI, so the newsletter was also able to provide them with specific information about their critical peak consumption and the benefits of load shifting. This information was conveyed through the mail, email, or an Internet website.

The results of the study showed that about 30 percent of residential and commercial and industrial customers said that the newsletter led to changes in their behavior. The remaining customers said that it did not change their behavior, or they did not even recall the newsletter. Additionally, the customers indicated that the energy orb was a more effective tool for inducing changes in their behavior.

Prepayment Metering

Prepayment metering can also have the effect of making customers more aware of their electricity consumption. While originally designed to help utilities collect payments from customers with poor credit histories, prepayment metering requires customers to pay in advance for the quantity of electricity that they

³ Nexus Energy Software, Opinion Dynamics Corporation, and Primen, “Information Display Pilot, Final Report,” January 5, 2005.

⁴ Another similar technology, The Converge Customer Alert Device, was also considered for the study but was not tested. The device displays sounds and colored lights to convey signals about prices.

will be using. As they deplete the purchased amount, they typically receive a warning that they need to buy more. Otherwise, the supply of electricity is cut off from the house until the customer has “fed” the meter.

In Ireland, Northern Ireland Electricity has keypad meters installed for 20 percent (125,000) of its customers. A study found that, with training, customers were able to reduce consumption by 11 percent. Even without training, customers reduced consumption by 4 percent. Prepayment programs in the U.S. include Tacoma, Washington’s “PayGo” program and Salt River Project’s program, which has achieved 10 to 20 percent savings across 31,000 participating customers.⁵

⁵ Kathleen Davis, “Prepaid Metering Can Bring Strays Back to Your Fold,” *Utility Automation and Engineering T&D*, May 2003.