Application Note # 3

Load Curtailment / Demand Response

Description of application: Load curtailment (or demand response) programs offered by utilities provide commercial and industrial building owners with reduced electrical rates in exchange for an agreement to curtail energy use at the request of the utility. Typically, these requests come during periods of high load such as hot summer afternoons. Building owners or managers who have the ability to reduce loads by turning off equipment or using alternative sources of energy can realize significant savings under these programs.

Background: Utility rate structures typically provide residential, commercial and industrial customers with fixed rates for energy regardless of the generating cost. Not surprisingly, these utilities use the most efficient (lowest cost) generating plants (e.g., nuclear and hydroelectric plants) for the bulk of their load and only bring on less efficient generation (e.g., older coal and gas-fired plants) as load requirements increase. Because of the essentially fixed price of energy to the customer, using less efficient resources has a negative impact on the utility's earnings and they would like to have alternatives.

For the utility, the best option at certain cost levels is to not bring on additional inefficient generating capacity and many utilities find that it is more cost effective to pay customers to curtail loads. If enough customers reduce their usage, the utility does not have to add generation (or purchase additional supplies on the spot market). This compensation can take several forms, but it generally is reflected in a lower overall rate schedule for the owner throughout the year.

How does it work: Load curtailment can take a variety of forms depending on the severity of the shortfall in supply and the type of agreement between the utility and the end user and the equipment in place to implement the reductions. In the simplest form, the utility notifies the owner of a curtailment request (typically a day in advance) and it is up to the customer to voluntarily meet the requested load reduction. Options for the end user range from adjusting temperatures to shutting off lights to closing facilities to meet the requested reduction levels.

The future of demand response is likely to contain more options for automatic, real-time reductions in load, triggered directly by the utility with little involvement of the owner. This option allows for the matching of loads much more closely to actual demand levels in real time, but obviously requires much higher levels of automation and investment. In this scenario, the owner and utility agree in advance what steps can be taken to lower the energy usage in the facility and the utility can initiate load reduction measures remotely using the customer's control system or additional controls installed in the building.

Benefits: For the utility, the primary benefits include:

- Eliminating the cost of bringing another plant on line
- Providing more cost-effective generating sources (i.e., more profit)
- Minimizing the environmental impact of generating plants with poor emissions records (fossil fuel plants)

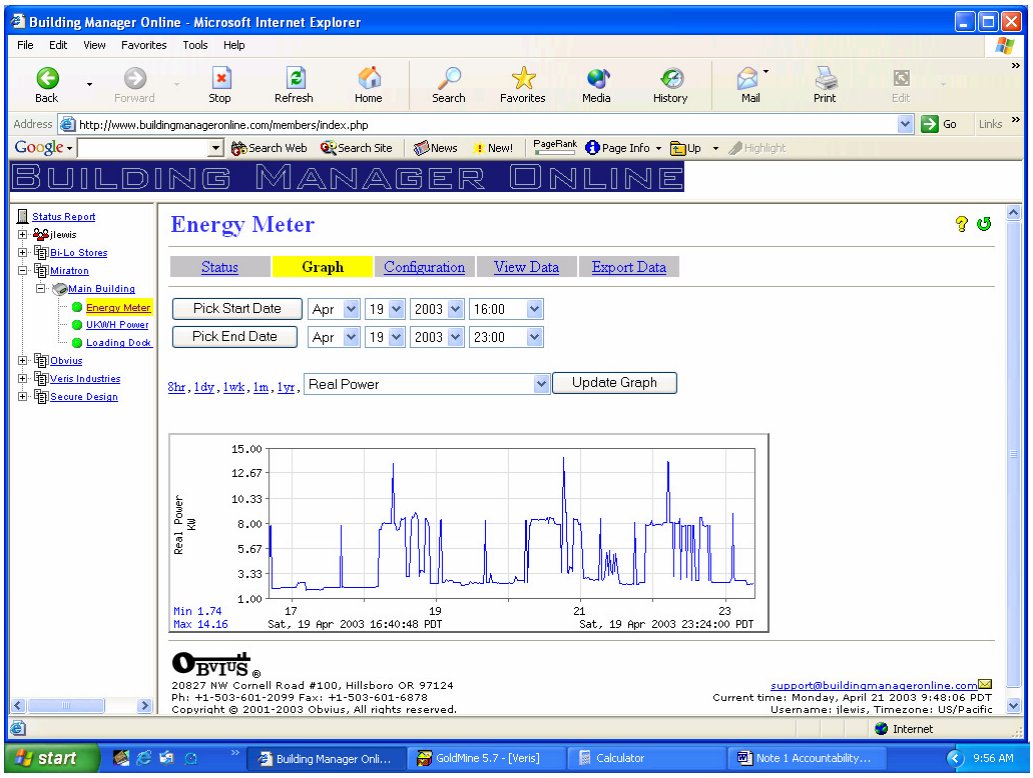
For the customer, the clear benefit is a reduced cost of energy in the near term and avoiding cost increases in the future since the utility is at least theoretically operating more efficiently. There may also be an additional benefit from the installation of controls and equipment in facilities that provide the user with more information and control over the operation of the facilities during periods when load curtailment is not in effect.

Drawbacks: From a financial perspective, both the utility and customer are likely to incur costs to add or retrofit controls and equipment in the customer's facility. Both must also commit ongoing resources to track and manage the operation of the load curtailment and to provide reports. The customer is also likely to experience inconvenience in the form of less comfortable space temperatures (i.e., higher in summer, lower in winter) than desired if HVAC equipment is shut off, or reduced lighting levels. This kind of program will clearly impact the customer in some respects and these effects need to be maintained within acceptable limits.

Installation requirements: Most facilities with installed building automation systems (BAS) already have the equipment in place to meet day-ahead requests by using the BAS to initiate new or pre-programmed operational strategies to limit energy use. The primary installation of new equipment could include additional metering and also likely some form of remote monitoring equipment to allow the utility to monitor the success of the program at reducing loads in the building.

Customers without existing BAS systems or those participating in real time demand response programs will have to make additional investment in monitoring and control systems (for example, remote setpoint thermostats). In most cases, the most cost effective way to implement a real time program is to use the Internet and web-enabled data acquisition servers (DAS) like the AcquiSuite from Obvius to provide real time feedback to the owner and the utility of the load before and after curtailment. The DAS can also function as the conduit for the utility to provide a supervisory signal to the BAS or to the systems directly.

Reports: The information needed to implement and evaluate the effectiveness of a load curtailment program is near real-time interval data (kW). This report (either for a single facility/meter or an aggregated load from multiple locations) might look like the following:



Analysis/Actions: The utility determines that there will be a shortage of available power (or that there will be a need to bring additional generating capacity on line) and informs users with demand response contracts that they will be expected to reduce their demand to the contracted levels. Users are expected to meet these requirements through some combination of automatic or manual shutdown of equipment, temperature adjustment or closing down some or all of their operations. The DAS is used to verify that the user has met the required load curtailment and that the utility has achieved its objectives for taking load off the grid.

Costs: As with all the application notes in this series, it is very difficult to estimate costs due to a variety of factors (wiring distances, communications issues, scheduled shutdowns, etc.), but some general guidelines for costs (hardware and installation) are:

- AcquiSuite™ data acquisition server - $1,800 to $2,200
- Electrical sub-meter (3 phase) - $600 to $1,000
- Data storage and reports - $20 per month per AcquiSuite™

Notes/miscellaneous: To date, implementation of demand response programs has been limited for a variety of reasons:

- Costs to monitor and control energy consuming equipment in buildings are high

- Implementation of these types of programs can be complicated, particularly if the utility desires some form of automated control via the internet
- Occupants have to be willing to except some inconvenience (e.g., higher temperatures) in order to meet curtailment needs
- Options for on-site generation (cogeneration, microturbines, fuel cells, etc.) are in the early stages and not cost effective for many owners
- Low overall energy costs provide limited incentive for negotiating curtailment contracts for many customers

All this notwithstanding, the future for load curtailment contracts is very promising. Improvements in building equipment (e.g., variable speed drives and on-site generating systems) combined with more cost effective Internet based data acquisition and control hardware and software greatly reduce the cost and impact of implementing demand response programs. DR programs are likely to become more prevalent and building owners would do well to stay abreast of developments in this area.

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