E360 Outlook | APRIL 2019

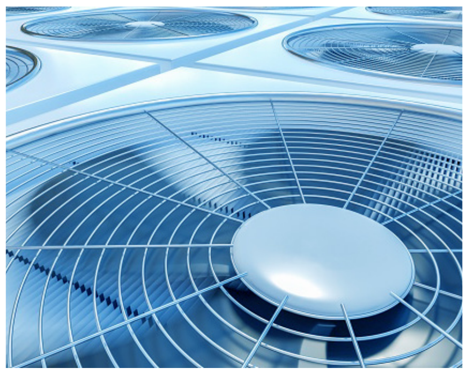
EMERSON

Reshaping the Energy-Management Equation

How evolving demand response and smart optimization strategies can help reduce energy costs

By James Jackson
Business Development Manager
Emerson

Supermarket chains are rife with energy optimization opportunities among their refrigeration, HVAC and lighting systems.



Energy cost reduction is a goal shared by most operators across the entire food retail spectrum. In recent decades, many supermarket, restaurant and convenience store chains have experimented with major energy retrofits, energy service company (ESCO) contracts, demand management and even on-site generation to help address rising electricity costs in individual stores and across their multi-site networks. These strategies were intended to help building operators lower energy consumption and/or qualify them for rebates and incentives from participating utilities. But as the energy and utilities sectors continue to evolve, traditional approaches to energy efficiency and demand response must also adapt to this changing landscape.

In many regions of the U.S., increasing contributions from renewable sources are helping to reduce the need to offset traditional peak demands. But these contributions aren't without their own challenges, as renewable power availability often changes or is unavailable when needed most. At the same time, the widespread adoption of the internet of things (IoT) is enabling operators to leverage smart devices, systems and technologies to fine-tune energy consumption within building envelopes — all of which is helping to reshape the energy-efficiency equation.

Nowhere is this more applicable than in supermarkets, where chains are rife with energy optimization opportunities among their refrigeration, HVAC and lighting systems. The average 50,000 square foot store incurs $200,000 in annual energy costs, resulting in 1,900 tons of CO_2 emissions — the equivalent of 360 vehicles — in one year. Of these costs, refrigeration and lighting account for more than 50 percent of total energy usage.

By utilizing automated energy management systems and control strategies, leaders in the retail space are uncovering previously hidden opportunities for seemingly small improvements — which when aggregated across a multi-site enterprise can add up to significant savings.

While these concepts may seem relatively straightforward in theory, implementing successful programs in today's challenging industry conditions can be far more complex in practice. Building envelopes are rapidly changing with the transition to smaller store formats and the introduction of omnichannel business models (click-and-collect or direct-to-consumer delivery). Rebate programs can be complicated, requiring both coordination and clear communication between facilities and utilities, and the automated control mechanisms in place to shift demand as required. In many cases, retailers lack the internal energy expertise to successfully drive these programs and benefit from them.

Fortunately, with advances in energy management systems (EMS) and controls technologies, retailers now have the ability to automate energy best practices across their enterprise networks for maximum efficiencies. These tools not only provide full building ecosystem optimization but also help operators capitalize on the potential for energy savings via utility energy incentives and available demand management opportunities.

Navigating this complex landscape requires a strong understanding of the current state of energy markets. What follows are some of the key developments impacting food retailers.

Understanding "consumption" and "demand"

To help put energy trends into context, it's important to first have a basic understanding of the difference between *electricity consumption* and *demand,* and how each impacts your utility bill. *Consumption* is measured in kilowatt hours (kWh) and refers to the amount of energy used during a billing period. Depending on your geographic location, your specific rate plan and your utility's standard and time-of-use (TOU) rates, kWh prices can vary widely. Understanding these factors is essential to developing a smart energy management strategy that includes avoiding intensive consumption activities during peak TOU rate periods.

Demand represents the instantaneous energy load that a commercial customer (or building) places on the grid. Utilities use this as a measurement on which to base infrastructure planning and determine the total load requirements of the electrical system. As demand increases, utilities are forced to draw from additional power sources, often more expensive reserve sources, like coal and other fossil fuels.

Utilities measure demand in kilowatts (kW) based upon the actual power a consumer draws. Because demand costs can be potentially higher than consumption — with charges ranging from a few to several dollars per kW — demand can account for a significant portion of your monthly bill. In a typical supermarket where refrigeration, HVAC and lighting systems are constantly in use to varying degrees, effectively managing demand costs is directly tied to how efficiently these systems are used and coordinated within a building.

Some food retailers may also be subject to utility-imposed *demand rachets,* which allow utility companies to establish a minimum billing based on the highest instantaneous demand measured during a billing period. Essentially, utilities can lock customers who may have inconsistent or seasonal energy requirements into this high-demand rate to ensure they're able to cover the consumer's peak usage periods. This is very important to understand for both new and existing facility operators, because if you don't properly manage the demand in your building, it could result in a more costly, long-term rate structure.

The common denominator in all of this is that it can pay to implement energy-efficiency and demand optimization/coordination strategies at both individual retail sites and across enterprise networks.

Redefining traditional demand response programs

One of the best places to look for the latest trends in the energy space is the state of California. With its progressive approach to sustainability, it is a forerunner in the implementation of strategies, policies and regulations which often influence the direction that the rest of the country will follow on related matters. Researchers at the Lawrence Berkeley National Laboratory (LBNL) in California have recently turned their attention to evolving the state's approach to demand response.

Traditional demand response programs are comprised of voluntary agreements between participating utilities and their customers, whereby customers receive financial incentives for reducing their electricity loads during periods of high prices or when the reliability of the grid is threatened. But in light of the rapid deployment of renewable generation, slow power plant retirement schedules and investments to California's grid, the state is now generating enough capacity to meet demand at peak times. This has offset the need for utilities to up their investments in demand response infrastructures, and caused disruptions in the ways that consumers have participated in traditional demand response programs.

LBNL evaluated California's energy dynamics and uncovered interesting findings that are also relevant to other states with similar energy profiles. The study drew from 200,000 customer load profiles from the state's three major utilities and evaluated them against a model of California's evolving grid over the next 10 years. Like many states, California is benefiting from an increase in contributions from solar power and the continued shift of demand from midday to evening hours. The proliferation of smart thermostats and controls in commercial and residential sectors is also helping the state optimize its energy consumption.

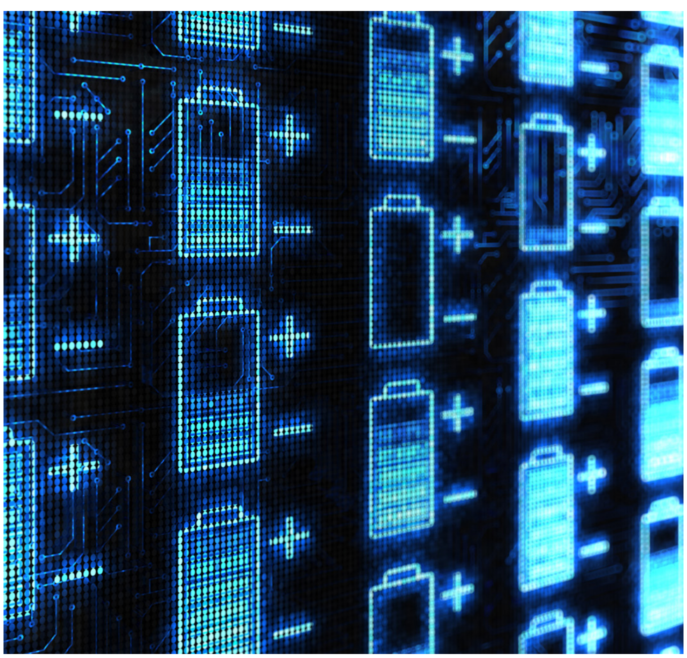
The LBNL study findings are helping researchers understand the amount of flexible customer load that is available and evaluate different methods for getting customers to change their energy consumption habits, such as TOU, peak pricing programs, and day- and hour-ahead energy market plans. With these strategies in mind, the study recommends replacing California's traditional demand response program with a four-pronged approach designed to incentivize consumers to adapt to the needs of the grid:

- ***Shape:*** reshape load profiles through TOU prices/incentives and energy-efficiency programs
- ***Shift:*** move energy consumption from periods of high demand to those times when there is a surplus of renewable generation
- ***Shimmy:*** dynamically adjust to loads within minutes or seconds in response to grid disturbances or short-run ramps
- ***Shed:*** curtail loads to provide peak capacity and support the grid in emergency or contingency events (much like conventional demand response)

While utilities are likely to incentivize all of these strategies per a consumer (or facility's) unique electricity requirements, the opportunity to shift demand is seen as the greatest contributor to future grid flexibility — and potentially one of the biggest opportunities for energy savings.

Self-generation via thermal and battery storage

In many regions, utility companies are also encouraging consumers to implement proven thermal and battery storage options to help shift demand from peak to off-peak hours. The concept of *self-generation* is relatively simple: thermal (ice) creation and battery charging take place during off-peak hours to store energy that can be used or discharged during peak hours to help utilities offset demand. Essentially, these options allow operators to augment their power portfolios and add flexibility to their energy consumption strategies.



States and utility companies are taking notice. The California Public Utilities Commission (CPUC) created its Self-Generation Incentive Program (SGIP) to incentivize the use of existing, new and emerging distributed energy resources such as battery and thermal. The use of EMS energy dashboards helps operators demonstrate the effectiveness of their self-generation practices and qualify for available rebates. As battery and thermal storage technologies continue to evolve, self-generation is likely to become a much more commonplace energy management strategy in the coming years.

Another indication of how utilities are shifting their focus is the emerging trend known as *non-wires alternatives* (NWA). Instead of investing in traditional transmission and distribution (T&D) infrastructures, many utilities are utilizing non-traditional resources like battery storage, flow control devices and demand response. This flexible, economical approach to managing transmission is helping utilities defer the need for specific equipment upgrades by reducing load at a substation or circuit level.

Grid-interactive buildings

As modern EMS and smart devices provide unprecedented IoT-enabled connectivity between consumers and utility companies, opportunities for greater cooperation and energy optimization are also on the rise. At the Department of Energy (DOE), the Building Technology Office (BTO) is conducting research through its Grid-interactive Efficient Building (GEB) initiative. Their stated goals are in alignment with many of the concepts presented in this article:

- Help bring connectedness — and the related energy savings — across the entire building sector.
- Allow American businesses and families to save energy and reduce their utility bills automatically, without impacting comfort or productivity.
- Enable buildings to be more responsive to electric grid conditions to reduce stress and build reliability.

At Emerson, we're helping to simplify energy management challenges with smart EMS software and proven controls platforms designed to help supermarket and restaurant operators connect with utilities and automate energy-saving best practices. With our portfolio of refrigeration and facility management assets, we're providing robust ecosystem building management, connecting devices and controllers to the cloud for comprehensive data management and analytics. We're ready to help you make the connection to greater energy efficiency and achieve operational success in a quickly evolving energy market.