

Energy Management Success Through Preparedness, Perseverance, and Partnerships: A Case Study

In Palo Alto, California, a municipal utility and one of its largest customers have built a solid relationship over the years, focusing on their mutual interests of peak load management, system reliability, and energy conservation. Roche Palo Alto (Roche PA), a pharmaceutical research and development company owned by Swiss healthcare giant Roche, has consistently reduced its energy consumption by continuous commissioning and implementing recommended retrofits. Since 1999, Roche PA's savings from conservation amount to 40 percent for electricity and 41 percent for natural gas. It is also able to significantly cut energy use within minutes to avoid forced outages. The secrets to this company's success in energy management are a strong partnership with its energy provider, regular monitoring of energy consumption to identify waste, and an internal billing system that rewards building occupants for frugal use of resources.

How They Did It

During the California energy crisis of 2001, City of Palo Alto Utilities (CPAU) needed some extra megawatts—and it needed them fast. Who could CPAU count on to respond to this urgent call to cut peak demand and overall consumption as the hot summer months approached? “Roche Palo Alto stepped up to help out in a big way, because they were able to act quickly. The close business relationship we've fostered together made this quick response possible,” said Bruce Lesch, key account representative at CPAU. Roche PA was able to cut its electricity consumption by 26 percent in 2001, not only cutting expenditures and saving itself from rotating outages, but also helping to keep the lights on and rates down for this entire Silicon Valley community.

Roche Palo Alto is a campus of 17 buildings comprising a little over one million square feet that primarily house laboratories devoted to pharmaceutical research and development. In just four months during the spring of 2001, Roche PA's utilities operations staff, with help from CPAU rebates, installed three large, high-efficiency chillers and 60 variable frequency drives (VFDs) on supply and exhaust fans in the HVAC systems, as well as extensive lighting retrofits.

At the same time, Roche PA was taking advantage of a California Energy Commission (CEC) grant to install and test a demand response control system. Even though the state and local programs operated independently, the company recognized the potential to boost energy savings by taking advantage of the opportunities simultaneously. “I saw how both programs could work together,” explained Jerry Meek, utilities operations manager at Roche Palo Alto. “The control system the CEC paid for was specifically for demand reduction, but I thought, I'm going to use it to turn the chillers on and off and control my VFDs. If I didn't have that control system ready by the time I put in the VFDs, the VFDs would be for naught.”

The new systems enabled Roche PA to cut 2.1 megawatts (MW) from its load in just 30 minutes, representing a 20 percent drop in its normal consumption. When CPAU paged Meek with a curtailment alert, he sent an e-mail to Roche PA staff requesting that they turn off lights and nonessential equipment. Meek also raised the cooling temperature and reduced fresh air intake. CPAU monitored the results with 15-minute interval data, while Roche PA watched its own 15-minute and real-time meters on each building.

Sources of Savings

Most buildings on the Roche Palo Alto campus were built before 1972, so there are many opportunities for energy conservation. For safety reasons, the labs need 100 percent fresh air night and day with no cross-contamination, making the HVAC system the largest power consumer. The following are just a few examples of measures Roche PA has taken to manage its energy use.

- **Cooling systems.** Roche PA replaced three large chillers with centrifugal chillers that are 60 percent more efficient. Spot cooling is used to keep some equipment cool day and night, rather than maintaining cooling in an entire building.
- **Ventilation system.** Variable-frequency drives were installed on ventilation supply and exhaust fan motors to increase system efficiency. Using a central control system, facility operations staff can adjust fan speeds according to time of day and day of the week, and adjust building ventilation based on outside temperature, time of day, duct static pressure, and building carbon dioxide (CO₂) levels. The annual energy savings is over \$500,000.
- **Fume vent hoods.** These are used in laboratories to exhaust air for health and safety reasons. They are very energy-intensive, representing close to 15 percent of Roche PA's pre-retrofit energy costs. The company found that lowering the maximum height of the sash—an adjustable screen that protects the user from exposure to chemicals—meant that less fan power was required to maintain proper airflow. In the retrofit, Roche PA lowered the sashes on 51 fume hoods; the cost of this project was \$105,000 and annual energy savings are \$80,000.
- **Lighting.** In just six weeks, over 27,000 lamps and associated ballasts were retrofitted to more energy-efficient models. For example, three- and four-tube T12 fluorescent fixtures were converted to operate with two T8 lamps with reflectors. Incandescent bulbs were replaced with compact fluorescent lamps and LEDs (light-emitting diodes) for exit signs. In addition, occupancy sensors in over 700 offices and labs ensure that lights are off in unoccupied rooms.
- **Employee action.** Roche PA's staff can achieve a 5 to 10 percent reduction of the campus's energy use by turning off lights, computers, and other equipment, and by scheduling experiments for off-peak hours.

But it's not just about demand response. Meek uses the control and monitoring systems to manage the facility's energy consumption every day. The combination of better controls and more efficient equipment enabled Roche PA to cut the campus's total load from about 10 MW in 2001 to 8 MW in 2004. (See **Figure 1**, next page.)

Be Prepared

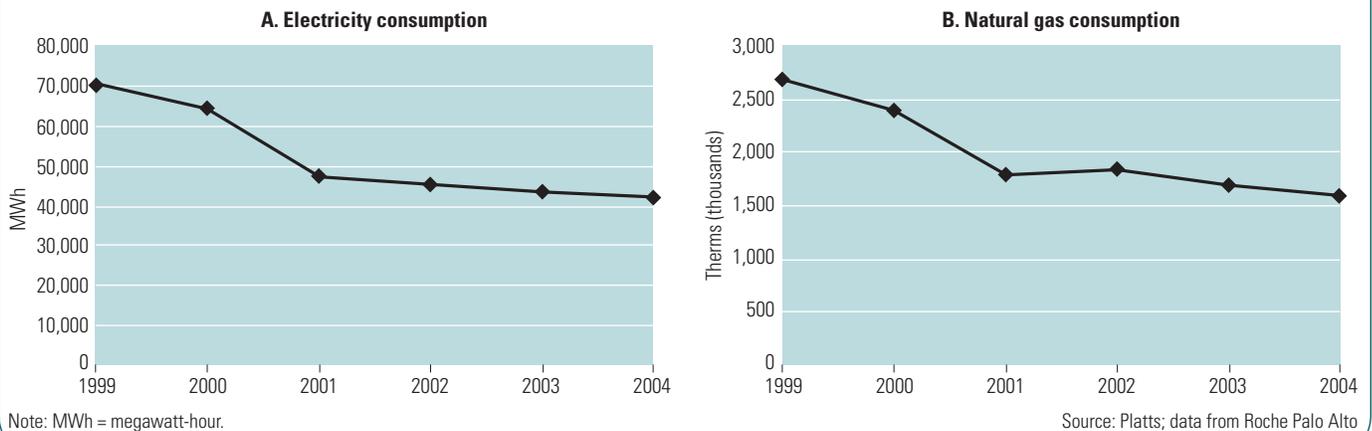
Jerry Meek was ready for CPAU when it called. He had a list of conservation projects for which he had gathered the data and analyzed the costs and benefits. "The list was already there; it was just a matter of implementation," said Meek.

For Roche PA, it paid to be prepared. It was able to take full advantage of emergency rebates from CPAU during the short window of time when the funds were available. Without the rebates, Roche PA would not have been able to justify investing in many projects for demand response or conservation purposes. Once the upgrades were complete, the company agreed to slash energy consumption by 10 to 20 percent within minutes during a California Stage 3 electric distribution system constraint alert. In return, the utility excluded Roche PA from rotating outages.

Years earlier, Roche PA had paid to be prepared for CPAU's call to action. In 1994, Roche PA invested some \$250,000 into a robust submetering system, including individual building meters and temporary meters on some equipment. Meek made a deal with Roche corporate management that he would reduce annual energy consumption by 5 percent for several years, but only if he were given this basic tool: building- and system-level energy data. Armed with a regular flow of consumption data, Roche PA's operations staff have been able to maintain a continuously updated to-do list of conservation projects, prioritized and categorized by season, return on investment, and whether they can be accomplished in-house. Initially

Figure 1: Downward trends

Since embarking on energy conservation initiatives in 1999, Roche Palo Alto has reduced electricity consumption by 40 percent (A) and natural gas consumption by 41 percent (B).



considered a cost that would not be recovered, the meter installations did turn out to have a payback. Using the new data, Meek and his staff were able to identify and implement enough no-cost HVAC energy conservation adjustments to cover the cost of the meters in just three years.

“After we got the metering in, we were able to evaluate energy use a lot closer and found that just doing some simple adjustments, little differences in [HVAC] time-sequencing or setpoints, saved us some money very quickly,” Meek said. Each year a new list of adjustments is identified and implemented, amounting to a continuous partial-commissioning program. For example, the pumps that distribute chilled water within each building were left to run continuously during the cooling season because it was too time-consuming to manually turn them off and on. In 2003, Roche PA operations staff automated the pumps by linking them to the central plant control system used to operate the chillers. The pumps are now activated according to outside air temperature, with estimated annual savings of \$200,000. In addition, the

company is able to keep costs down by having in-house staff do most of the work. Not only does this approach save money, but the operations staff also develops in-depth knowledge of how to maintain the systems.

The Customer’s Customer

“Just coming up with a project is one thing. But implementing and getting consensus [from building occupants] is another. That is always the hardest part,” cautions Meek. “A facility manager can have lots of ideas, but trying to sell the idea and get consensus can be much more difficult.”

Meek’s approach to getting buy-in from building occupants is to pass the savings on to them, freeing up funds for other purposes. Relying on the meters installed across the campus, Roche PA’s operations department bills each building by volume of consumption for electricity, natural gas, and chilled and hot water. Because each building is directly responsible for paying for what it consumes, the occupants are happy to work with the operations department to trim their bills.

To start off on good terms with building occupants as he embarked on conservation projects, Meek first looked for opportunities to excise waste in central plant operations. That way, if he could reduce costs by installing a more efficient chilled water system serving multiple buildings, for example, he could bill everyone a little less for chilled water. There was no negative impact on building occupants: They can use the same amount, but are billed at a lower rate.

By setting a good track record for improvements to the central systems, and passing those savings on to his internal customers without asking anything in return, Meek established an excellent foundation for implementing building-specific changes that occupants may perceive as inconvenient. His department was then able to negotiate adjustments such as temperature setpoints, humidity levels, and the number of air changes per hour in individual buildings. “If I didn’t get buy-in from the user communities in these various buildings, then we would not have been able to move forward,” said Meek.

Corporate Citizenship Matters

Saving energy helps Roche PA meet broader environmental goals as well. Each year the company establishes annual emission-reduction goals for CO₂, sulfur oxide (SO_x), and nitrogen oxide (NO_x), and reports on emis-

sions performance. Roche PA has reported consistent emissions reductions of 30 percent since 2000. Energy conservation also contributes to water savings and reduced use of chemical treatments for Roche PA, because less water is required to operate chillers and boilers. Plus, the company announced in July 2004 that it will purchase green power equivalent to 5 percent of its load from CPAU’s PaloAltoGreen program. “With energy savings putting us below budget for the year, we were able to purchase green power and still stay within budget,” Meek explained. CPAU rebates in 2004 helped him to exceed energy savings expectations.

The company has also encouraged cooperation among its neighbors in the business community. Roche PA’s previous president, James Woody, knew that he could pay lower energy rates and reduce the risk of forced outages if other businesses in the area also cut energy consumption. So he took an active role in forming energy management programs through the Silicon Valley Manufacturers’ Group. Roche PA cut its energy consumption significantly, thanks not only to smart technical choices but also to building good relations on all sides—internally between operations and laboratory staff, and externally with its energy provider and corporate neighbors.