Case Study: Opto 22 Energy Management

With the Cost of Power on the Rise, Opto 22 Cuts Costs by Leveraging Information and Communications To Analyze and Reduce Its Energy Use

Background

In the US, the dramatically rising cost of power has made energy management a priority for businesses large and small. Temecula, California-based Opto 22, a maker of industrial automation products, in efforts to trim its energy bills in the most cost-effective way, recently began collecting relevant consumption data and more closely tracking its power usage. Ultimately, this led the company to better understand the power demands and consumption of key equipment and systems in its facilities and to develop new energy management strategies and practices.

Southern California Edison (SCE), Opto 22's power provider, classifies the company as "TOU-8"— a large-sized commercial and industrial customer that registers power demands greater than 500 kWh daily. As a result, Opto 22 is subject to peak pricing, which means that on any given day, if the company exceeds an established threshold (even briefly) it's charged a peak usage rate for the entire day. It should be noted that Opto 22 is headquartered in a 160,000 square foot building in Temecula, California, halfway between Los Angeles and San Diego and close to Palm Springs. The summertime climate in this area is very warm with daytime highs that can reach into the 100s. Naturally, under these conditions, the HVAC systems used to cool the Opto building consume a great deal of power, as do the company's huge variety of assembly, handling, and other manufacturing machinery.

Opto 22's corporate office sits under the same roof as the factory and is home to many of the company's engineering, sales, marketing, accounting, and other personnel. Thus, with all product development, manufacturing, shipping, and other operations taking place in a single facility that requires a tremendous amount of cooling, it's easy to see how the company's energy bills became alarmingly high.

Opto 22's leadership knew it had to decide how and when critical manufacturing equipment, lighting, and other support systems would operate, and what policies needed to be adopted to reduce the company's power bill.

Observing and Reporting

Understanding that one can only effectively manage that which can be measured, Opto 22 deployed a monitoring and data acquisition system designed to capture real-time energy consumption data. The specific data acquired would give the company the confidence it needed to modify power-intense processes, curb its power use, and draft energy-conscious corporate policies.

The Ethernet-based system selected possessed innate communications capabilities that allowed it to operate within the company's existing information technology (IT) infrastructure. The system was also capable of communicating via the Internet, as it was based upon the Internet Protocol (IP). These features made it very easy to share acquired energy-related data and make it

Businesses pursue energy management initiatives for many reasons: a sense of corporate responsibility, efforts towards sustainability, and fear of power shortages. However, the greatest motivating factor is the huge opportunity for cost savings derived from establishing effective energy management practices in everyday operations.

accessible from PCs, touch screens, and mobile devices whether in the office, on the factory floor, or off site.

With the acquired data, Opto 22 was soon effectively tracking its overall power usage within its manufacturing facility and its adjacent corporate headquarters. Additional monitoring systems were connected to the building's lighting and HVAC systems to determine exactly when and how each system was operating, and how much it contributed towards the total power draw. Finally, easy-to-understand graphic illustrations of the Opto 22 facility and its key machinery and equipment were created. One such graphical representation incorporated the various areas within the two halves of the building, their respective temperature set points, and their actual temperatures. A color-coded gradient map was designed to indicate how closely the actual temperature in an area matched the predefined set point. Another graphical representation demonstrated how the individual HVAC equipment (air handlers, chillers, fan coil units, and so on) functioned. The company used these graphics to obtain at-a-glance information on HVAC operation, to identify trouble spots, and to confirm when and how hard the HVAC equipment was working.

Analysis of all this new data went far and beyond what a simple monthly power bill could offer, and instead provided evidence as to what was causing the company to routinely exceed its 800 kWh per day limit and incur significant peak charges—often amounting to tens of thousands of dollars per month.

Enabling Technology

Because the system deployed was based on standard information and communication technologies (ICT), it was able to stream the energy data in real time so facilities personnel and others were able to quickly establish correlations. For instance, on the corporate side, an extra-large power demand in the mornings was attributed to the HVAC system, as it struggled to counteract the quickly rising outdoor temperature. Monitoring the lighting systems revealed that much of the manufacturing facility was still fully lit more than two hours after most of the factory workers had left for the day. And throughout the facility, cooling fans and four air handlers—very large HVAC units containing a blower, filters, dampers, and other components—were operating and attempting to cool the building almost constantly.

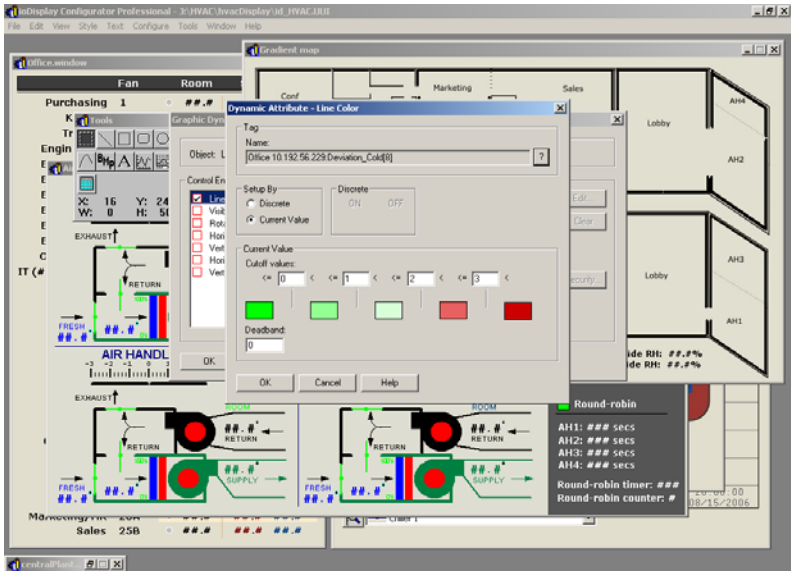
What made all of these determinations possible was the real-time, ICT-based energy monitoring and data acquisition system and the very detailed information it was able to deliver. The information provided on a monthly power bill doesn't help when attempting to develop an energy management strategy, largely because that bill shows little detail and arrives days or weeks after the actual consumption has taken place. Opto 22, like all energy customers regardless of their size, only gain value when they're able to see, understand, and associate equipment that is operating, processes that are taking place, and decisions that are being made, with changes in power draw (and the subsequent increase in charges that are being incurred).

Gaining Control

As is the case with all intelligently executing systems, data is processed and then decisions are made, and action is taken. Consider: you step out your front door and feel a chill and a drop of rain. You then process this data you've acquired, make your decision, and take action by going back inside and grabbing a jacket and umbrella.

Southern California Edison classifies Opto 22 as a "TOU-8" customer subject to peak pricing.

Opto 22's energy management efforts followed this same paradigm. The sobering data gathered by the system made the company more conscious of its daily energy use and provided the motivation to change behaviors and correct wasteful practices, sometimes within mere minutes of reviewing the data. In this regard, adoption of new company rules and policies significantly contributed towards reducing power demand. For example, employees were urged to shut off their computers and monitors before leaving the office; engineers no longer left test equipment running when it wasn't necessary; and to help negate the warming effects of the sun, the building's roof was painted white and the building's sun-facing windows were covered in reflective film.



HMI screens display HVAC equipment operation and color-coded representations of temperature setpoints compared to actual temperatures.

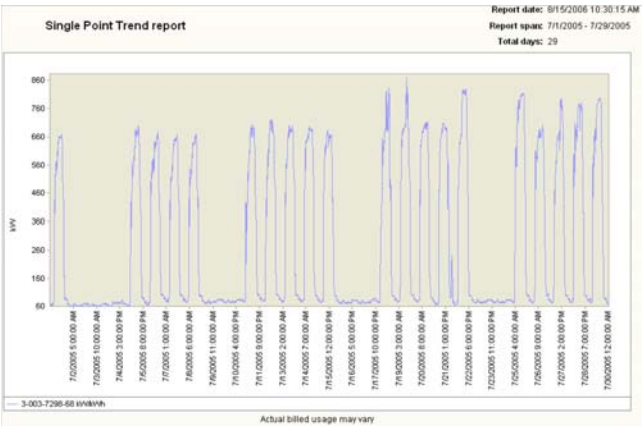
But these simple, almost common-sense strategies were just the beginning. Close scrutiny and monitoring of the HVAC system revealed that some facility equipment was not performing to specifications due to faulty components. Specifically, valves were not properly operating to deliver the cold water/glycol mixture for the air conditioning. This malfunction was immediately recognized as an opportunity for significant energy savings. The rationale was that if the valves worked properly, the cooling process would more quickly adjust, and the HVAC system would reach set point faster, thereby saving energy. Closer inspection revealed more failed HVAC system components, including fans that wouldn't turn on, broken fan belts, and burned-out motors. Action was then taken. Replacement of blown servo motors ensured that the water/glycol mix got through, and additional repairs soon had the HVAC system performing optimally.

A competent manager would never approve a major expenditure without a detailed accounting of where the money is being spent. However, energy is not accounted for in the same detailed manner. Energy costs must be treated and managed the same as other costs within a business (such as people, capital equipment, and inventory). Resulting detailed assessments will present opportunities—significant and largely untapped—to improve the bottom line.

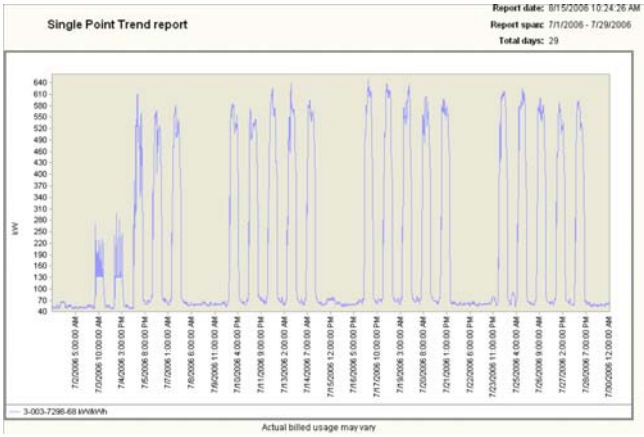
A good deal of power was also saved by the decision to shut off lights in the manufacturing facility at the end of the work shift. It was concluded that with daily manufacturing operations ending in the early afternoon and the vast majority of factory workers leaving at that time, natural sunlight would be sufficient for the remainder of the day.

In this and all instances, it was the newfound visibility provided by the energy monitoring system that opened Opto 22's eyes to its uneconomical use of power. Once enough energy consumption data had been aggregated, this new awareness provided the impetus for the adoption of more energy-efficient strategies and later, the decision to automate or control specific systems and processes in order to temper consumption and use power in a more efficient way. Significantly, these automation and control capabilities were incorporated into the existing energy monitoring system.

For example, with regard to the problem of excessive energy use by the HVAC system during the morning hours, it was decided that temperature probes would be used to monitor the outdoor temperature each morning. The energy monitoring system had the programmability and intelligence needed to gather that temperature reading and to execute a "pre-cool" strategy that opens HVAC dampers and flushes out the existing air in the building to provide a running start on cooling the facility. Once the system reads an outside temperature above 70 degrees, the dampers are closed. This strategy stretches the company's energy dollar by avoiding the counter-productive practice of sucking in warm air and circulating it through the building. With the chillers not having to work as hard to remove heat from the building in the morning, energy is saved.



Before: Opto 22 had peak loads up to 860 kW



After: Peak loads were reduced to under 640kW

Next, the operation of 30 small fan coil units used to cool the corporate side of the building was improved. Previously, in efforts to maximize cooling, these fans were operating all day in unison. A new energy-conscious approach towards facility equipment management divided these units into smaller groups and switched each group on only when their assigned area of the building needed cooling. Now, the fan coil units turn on and off as needed instead of running ten hours a day, which helps the company avoid SCE's costly peak pricing, while still keeping the actual temperature within two degrees of set point. Once again, before this control technology was applied, the specific steps that needed to be taken were identified and made clear by the wealth of information obtained through energy monitoring. And because control could be exercised using the same physical connections and communications media that were already in place, this became the logical next step.

Before and After

After installation of the ICT system, and the new control techniques were designed and implemented, Opto 22's daily kWh hour totals dropped from between 660 and 871 to between 525 and 588— a 27% percent reduction in consumption that equated into literally thousands of dollars saved. In spite of almost monthly double-digit price increases, cost-wise, the company was able to keep its bill at virtually the same level.

The real-time information provided by ICT offers numerous opportunities for cost savings. As power companies increasingly offer heavy energy consumers incentives if they can decrease their consumption during hours of peak demand (or charge premiums if customers exceed their thresholds) it is extremely advantageous for organizations to understand how and when their business' power usage fluctuates throughout the day. In this regard, a real-time energy monitoring and data acquisition system is what's first required for the purposes of discovery. Then later, the same system can be easily augmented to control and manage machines, devices and equipment and effectively load shed in efficient, cost-cutting ways.

About Opto 22

Opto 22 develops and manufactures hardware and software for applications involving industrial automation and control, remote monitoring, and data acquisition. Opto 22 products use standard, commercially available networking and computer technologies, and have an established reputation worldwide for ease-of-use, innovation, quality, and reliability. Opto 22 products are used by automation end-users, OEMs, and information technology and operations personnel. The company was founded in 1974 and is privately held in Temecula, California, USA. Opto 22 products are available through a worldwide network of distributors and system integrators. For more information, contact Opto 22 headquarters at +1-951-695-3000 or visit www.opto22.com.

Opto 22's implementation of information and communications technology gave the company a better understanding of its HVAC chillers and other energy consuming equipment.

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