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Developing a Plan for Reducing Energy Costs in Hospitals

Focusing on the ways that healthcare organizations use energy can uncover valuable strategies for reducing energy use and expense.

By Alan Whitson

Too often, “engineering speak” rules the conversation about energy use in hospitals. Although terms such as “thousand BTUs per square foot a year” are helpful in comparing the energy use intensity among buildings, using other metrics can provide senior hospital executives with actionable insight for cost savings.

Looking at energy costs per square foot, for example, reveals hospitals are high consumers of energy. Hospitals actually consume more energy per square foot than any other building type except fast-food restaurants. A hospital with 1 million square feet uses 2.5 times the energy as a similar sized office building. This makes hospitals a priority energy-reduction target for the Department of Energy and the Environmental Protection Agency (EPA).

The average U.S. hospital spent $6.08 a square foot on energy in 2008, according to the EPA. Since the average hospital is about 288,000 square feet, this translates to $1.75 million a year in energy costs. And, those costs are quickly rising.

From 2005 to 2007, the average cost of electricity in the United States increased 36 percent. In some markets, the increase was more than 60 percent. Although the recession slowed the pace of increase for the short-term, long-term energy costs will rise in a response to increased demand and regulatory pressures on carbon emission.

The U.S. Energy Information Agency (EIA), in fact, predicts the average cost of electricity to commercial users in the United States will almost double between 2011 and 2035. Other forecasts call for an increase twice the size of the EIA’s prediction.

The good news is that there are many opportunities to reduce hospitals’ energy use, which can add to a hospital’s bottom line. According to the American Hospital Association, the average total margin for U.S. hospitals was 5 percent in 2009. Therefore, cutting energy costs $1 a square foot is equal to adding $20 a square foot, or $5.76 million, in new revenue for the average-sized hospital.

Room for Improvement

Hospitals have higher energy use for various reasons. Unlike a house, internal loads are a dominate factor in hospitals. This means what happens inside the hospital has a bigger impact upon its energy use than the climate zone where it is located. It also means hospitals have greater opportunity for controlling internal loads and, therefore, their energy costs.

Although hospitals are viewed as 24/7 operations, many areas do not operate around the clock, meaning, for example, that lights can be turned off. In areas that operate around the clock, small changes can create large savings. For example, dimming fluorescent lamps from 100 percent to 75 percent light output reduces energy use by 25 percent. Because humans can rarely distinguish between a 100 percent light level and a 75 percent light level, it is an easy transition. Take this strategy one-step further by having different light levels for daytime and nighttime. Time clocks, occupancy sensors, photo sensors, and dimmable ballast can create multiple ways to save energy by tuning light levels and turning lights down or off when no one is present.

Utilities costs vary widely among hospitals. A 2010 study by the International Facility Management Association/American Society for Healthcare Engineering revealed a significant cost spread regarding utility dollars per discharge. The cost for the 75th percentile is 77.1 percent larger than the median, which is 52.5 percent larger than the 25th percentile. The average cost is

35.5 percent more than the median. Climate and fuel cost alone cannot account for such a large spread. This translates into a large opportunity for cost savings.

The consensus among architects, engineers, and facility professional is that a new hospital can use significantly less energy than the average hospital of today. Cutting energy use by 50 percent in an existing hospital is achievable with today's technology and best practices.

Using current averages, reducing hospital energy use by 50 percent will increase a hospital's total margin by 20 percent or more.

Develop a Holistic Plan

Many healthcare organizations fall into the trap of "cherry-picking" projects for reducing energy load that require little capital and have a simple payback period of less than three years. The downside of this strategy is that it fails to consider that buildings are a series of interrelated systems. As a result, many opportunities for synergistic improvement are missed. A better method considers where and when energy is used and how a hospital's various systems interact to produce a systematic plan for improvement.

A systematic approach to energy efficiency is best, as small performance improvements in one area can create larger savings in other areas. This creates leverage, which multiples the financial and engineering impact of every dollar invested and increases the total return.

"By the very nature of how hospitals use energy, making investments to reduce energy costs is a rock solid strategy," says Brian Weldy, vice president of engineering and facility management at HCA Healthcare, based in Nashville. "The key is to create a good balance between fine-tuning the operations of existing building systems, and a well-conceived capital reinvestment plan for your facility infrastructure. This alone can produce a 20 percent savings."

Here is a five-stage approach wherein each stage creates leverage for upgrades in later stages. This approach ensures the greatest possible energy and cost savings with the minimum amount of capital investment.

Retrocommissioning offers insight into how the hospital's systems are performing and how closely they run according to the original intentions of the engineers. Specifically, this stage identifies improper equipment sequencing, equipment or systems that need to be repaired or replaced, and tactics for improving building performance. This information becomes the foundation for defining a scope of work and developing preliminary budgets for the remaining four stages.

Lighting upgrades, which can include new light sources, fixtures, and controls, are next, because a facility's lighting system has a significant impact on other building systems. Lighting is the third largest area of energy use in the typical hospital and affects heating and cooling loads and power quality. For example, 80 percent of the energy used by a fluorescent lamp becomes heat; only 20 percent of the energy converts into light. The current state-of-the-art technology in lighting can cut energy use by 70 percent or more and provide better visual acuity.

Reviewing the impact of supplemental load sources, such as building occupants and electronic equipment, is critical because they contribute to energy use. These sources can affect heating, cooling, and electric loads. By analyzing these sources and their interactions with HVAC systems, equipment size and future upgrade costs can be reduced. Another secondary load source is the building envelope: walls, roofs, windows, and sealants. Water leaks, air infiltration, and inadequate or poorly installed insulation can affect heating and cooling loads. This creates an opportunity for mold and its negative impact on indoor air quality and patient safety.

Modifying the air distribution systems also is important. These systems bring conditioned air for heating or cooling to building occupants and affect both energy use and occupant comfort. Fan systems can be adjusted or upgraded to deliver air in the most energy-efficient way possible. Minor adjustments such as fan belt alignment and filter type can have a dramatic impact on indoor air quality, energy use, and maintenance cost.

Completing the first four stages can reduce heating and cooling loads. This reduction, coupled with the fact that many HVAC systems are oversized, means that it is possible to justify replacing an existing system with one that is sized properly or retrofitting a system so it runs more efficiently. In addition to saving energy, proper sizing can reduce noise, lower the first initial costs for equipment, and optimize equipment operation, often leading to lower maintenance costs and longer equipment lifetimes.

Added Benefit

Reducing costs effectively helps to secure an organization's financial future. But, making a hospital more energy efficient has long-term benefits that extend beyond the bottom line.

"The wonderful thing about making energy saving improvements is that these efforts boost the reliability of building systems and improves indoor air quality," Weldy says. Lighting upgrades not only save money, but also enhance the aesthetics of interior spaces. Overall, energy conservation helps to enhance the patient care delivery environment and makes for a happy CFO."

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