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Energy

High-Tech Means High Efficiency

Gary Shamshoian and Colleagues 11.18.05, 1:04 PM ET

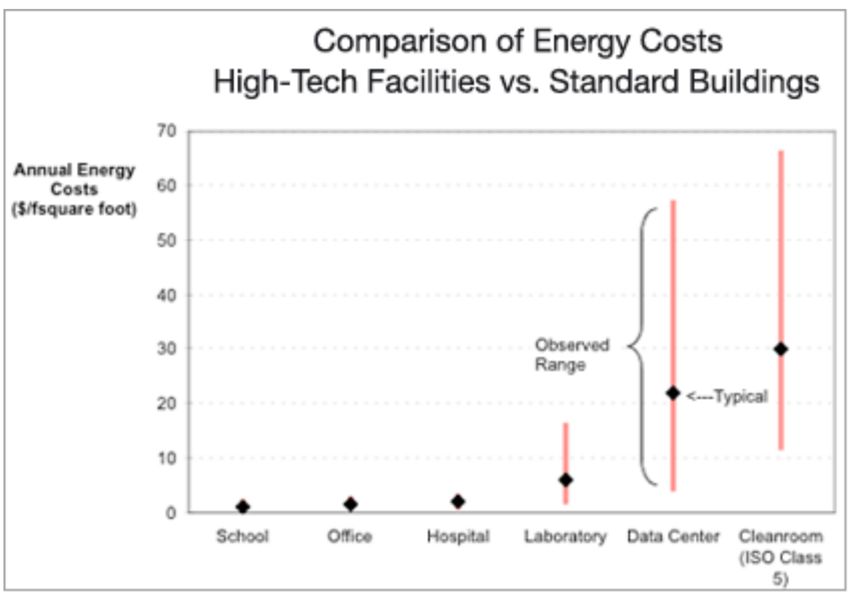
Among technology-based businesses, improving energy efficiency presents an often untapped opportunity to increase profits, enhance process control, maximize asset value, improve the workplace environment and manage a variety of business risks. Oddly enough, the adoption of energy-efficiency improvements in this industry lags behind many others.

In the race to apply new technologies to making bigger, better, faster data centers, laboratories and cleanrooms, the energy efficiency of individual equipment ranging from servers to facility heating and cooling systems often gets overlooked among the other improvements. So, too, does the integration of high-tech equipment into the power-distribution system and the fabric of the building. As a result, billions of dollars of potential energy savings are wasted each year.

Freescale Semiconductor, a spinoff of Motorola and the third largest chipmaker in the U.S., is one company that instituted energy-efficiency policies. It has gained reoccurring annual savings of more than $4.5 million.

Energy inefficiency is a symptom of organizational inefficiency. Facility engineers in the trenches can identify opportunities to improve energy productivity, from upgrading minor components to optimizing entire systems, but if there is a cultural divide between these engineers and corporate decision makers, promising projects die on the vine.

Industries that have high-tech facilities require particularly energy-intensive buildings that run 24/7, so energy-efficient design and operation provides significant leverage to reduce overall operating costs. Cleanrooms and high density data centers can use up to 100 times as much energy per square foot as a typical office building (see chart), and have energy bills of more than $1 million per month.



Recent studies show that some owners saved a quarter or more of a building's energy costs through efficient design without increasing the capital costs. Integrating energy efficiency throughout the design process also yielded significant first-cost savings for many projects. In one of many examples, a major data center expanded its computing power by 25% while keeping total energy use unchanged; across a fleet of 36 data centers we studied, efficiency upgrades are saving more than $2 million per year for an investment of only $0.5 million.

The energy-efficiency measures included better optimization of power distribution units, power management modules, computer room air conditioning units, optimization of operating conditions, facility-wide lighting upgrades, and improved facility controls. Additional savings can be achieved by improving efficiencies within the IT equipment network.

Similarly, our field studies of mid-sized cleanrooms identified a twentyfold variation in air-recirculation energy use for similar levels of contamination control, suggesting a cost savings of $400,000 per year, per cleanroom for efficient best practices.

Capital and operating cost impacts must be considered in tandem in order to realize maximum value from facility improvements. Historically, many of the business cases for the development of cleanrooms and other specialized high-tech facilities have focused on the revenue and capital costs of revenue-producing equipment. Operating expenses such as energy consumption and building-related capital costs have received scant attention.

In the case of power consumption, the fluctuation in price and other constraints are often unanticipated--particularly for peak periods. In some cases, risks and liabilities associated with power failure are clearly overestimated, resulting in the over-design of backup-power systems. Also, risk-adverse choices in the backup-power technologies with the emphasis on proved technologies often result in missed opportunities for savings in capital and operating expenses.

There are a host of competitiveness-based reasons for pursuing energy efficiency. The operating costs to deliver products and services have been key to driving margins and influencing stock prices and earnings per share in high-tech corporations. With rising energy prices and increased frequency of power outages, in-house energy-reliability improvements and energy management have assumed more strategic importance for upper management.

There is also a growing body of evidence that energy efficiency is associated with a healthier and higher quality work environment, especially regarding the use of outside make-up air. On a life cycle basis, the energy consumption of high-tech systems can be the most significant source of environmental impacts.

Energy efficiency is the keystone for the burgeoning sustainable/green-buildings movement, and broader trends toward corporate responsibility. Voluntary and mandatory programs ranging from labeling schemes to building standards are also driving the process.

Business leaders such as Arden Realty, Marriott International and the **Vanguard Group** are increasingly seeking to go green. The Energy Star and Leadership in Energy and Environmental Design (LEED) labeling initiatives are the best-known national recognition programs, with thousands of buildings rated thus far. The Department of Energy/Environmental Protection Agency Laboratories for the 21st Century program brings these principals to bear on high-tech laboratories.

The high-technology sector is often where innovation first occurs. Its facilities are sometimes referred to as the "racecars" of the buildings sector because new technologies and strategies to increase performance trickle down to other building types, just as automakers test their newest technologies on the racetrack before putting them into production vehicles.

Changes in design practices can be challenging. The extreme criticality and high capital costs involved requires confidence in the facility procurement process. The "racecar" analogy must not result in increased chances of system failures: Appropriate design practices must include risk analysis and redundancy for reliability enhancements.

This article was written by Gary Shamshoian, senior mechanical engineer, Genentech; Michele Blazek, director, Technology and Environment, AT&T; Phil Naughton, Freescale Semiconductor assignee at SEMATECH; Robert S. Seese, principal, Critical Facility Associates; and Evan Mills and William Tschudi, staff scientists , U.S. Department of Energy's Lawrence Berkeley National Laboratory. The views expressed in it are those of the authors, who have published a more detailed exploration of these issues.

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