

## The Benefits of Lean and Clean

**M**ILLIONS of people spend their working days in settings that are too hot, too cold, too noisy, too bright, or too dim. Much has been made in the last decade of how much energy such practices waste. But there is an even more compelling reason to make the workplace more comfortable: higher productivity.

Lean-and-clean design means giving workers the lighting, heating, and cooling they need for their specific jobs; any more is not only wasteful but also creates poor working conditions. The resulting growth in profits from rising productivity can exceed the bonus from energy savings by a factor of 10. As an added benefit, some of these upgrades can also improve indoor air quality. And by taking conspicuous steps toward environmental responsibility, companies can reap a public relations reward.

The first thing a lean and clean company should do is replace old lighting. This one simple step may improve the quality of work in any company, particularly one whose employees are involved in precise detail work. According to a 1991 Harris Survey, 47 percent of office workers report eye strain on the job. The Environmental Protection Agency's Green Lights program is a good source of information not only on lighting technologies that work best for particular applications but also on financing opportunities.

Three examples illustrate the potential benefits. Boeing recently upgraded more than one million square feet of its jet-manufacturing facilities with new, high-quality lighting. Because these lights use as little as one-tenth as much

*Energy-saving improvements in workplace lighting, heating, and cooling can also boost productivity and profits.*



electricity as the ones they replaced, this change paid for itself in two years in energy savings alone. But the upgrade also reduced errors by replacing fuzzy, distracting lighting with fixtures that provided crystal-clear vision and excellent color rendition.

For example, in one Boeing shop, workers use numerous fasteners to attach a jet's interior wall panel to a stiffening member. The old fluorescent lighting provided poor contrast and made it difficult to tell if a fastener had been properly attached. Many errors went unnoticed until the panel was installed in the airplane, where it is far more expensive to fix. The shop now uses metal-halide lamps, which improve the workers' ability to detect imperfections in the shop by 20 percent. One Boeing manager estimates that this early detection of mistakes yields a bigger cost savings than

the reduced energy consumption.

The main post office in Reno, Nev., has experienced similar savings. Postal workers operate two sorting machines: every second, the machine drops a letter in front of the operator, who must punch in the correct zip code before the next letter appears. Employees long performed this task under harsh, direct, overhead lighting.

A few years ago, the post office remodeled the room housing one of the two sorter machines, giving it less intense, indirect lighting. A lower ceiling enhanced this lighting—a change that also made the room easier to heat and cool and improved acoustics. Productivity rose 6 percent, and Reno's mail sorters became the most productive and error-free in the western United States. The productivity gain and error reduction save more than \$400,000 a year—about eight times the cost reduction from lower energy use, and more than enough to cover the \$300,000 cost of upgrading the entire building.

In Lawrence, Kan., Wal-Mart discovered almost by accident the business benefit of good old-fashioned daylight. Extensive use of daylight lowers the cost of electrical lighting and can reduce the need for air-conditioning. But the retail giant discovered a productivity advantage as well. To save money, Wal-Mart put skylights on only half the roof. The company then discovered that the volume of sales per square foot was "significantly higher for those departments located in the daylit half of the store," according to Tom Seay, Wal-Mart's vice-president for real estate, and exceeded that of the same departments in other Wal-Mart stores. This result fits with the findings of many studies and surveys, which have shown that people prefer daylight to artificial illumination.

To further enhance both energy efficiency and productivity, new systems make it possible to tailor the environment of a small workspace to the com-

fort of an individual. No longer need the entire heating and cooling system be driven by a manager or by a few vocal employees who want it hotter or colder than everyone else.

West Bend Mutual Insurance has reaped substantial benefits by incorporating "environmentally responsive workstations," or ERWs, into its new headquarters building in West Bend, Wis. Radiant heaters and vents are built directly into furniture and adjusted by a desktop control panel so that workers can have direct control over the temperature and airflow in their workspace. Workers can also adjust individual task lights to the desired level of brightness. These workstations let individuals create a customized workspace environment that might differ considerably from one preferred by the person at the neighboring desk.

Thanks in part to the ERWs, electrical cost per square foot of the new headquarters is 40 percent lower than in the old building, and worker productivity is 15 percent higher. A number of factors have contributed to this improvement, but researchers from the Rensselaer Polytechnic Institute found, by turning off selected ERWs at random, that the workstations alone boosted productivity by at least 2.8 percent. This gain represents a ten-fold greater cost savings than that from lower electrical use.

The next few years will be an especially opportune time for companies to institute lean-and-clean technologies. One big impetus is the phase-out of chlorofluorocarbon (CFC) coolants, which will force most companies to replace their central air-conditioning systems with versions that can use non-CFC coolants. But a systematic, multistep approach to making the building more energy efficient can turn what might have been a costly change into a chance to increase profits and productivity. A company should first reduce the cooling load through an energy-efficient lighting system (which puts out less waste heat), better insulation, new windows, a more reflective roof, and variable-speed motor controls on ventilation fans. The

replacement cooling system can then be half the size of the existing one, dramatically reducing the cost and yielding paybacks for the entire building upgrade of two to five years.

Many lean and clean technologies are the direct result of public investment by the Department of Energy's energy efficiency program. For instance, a \$3 million investment in the late 1970s helped two small businesses develop a high-frequency electronic ballast, which efficiently powers fluorescent lamps without the distracting hum and flicker. These ballasts have already saved U.S. businesses \$850 million in energy costs, according to the Lawrence Berkeley National Laboratory. The program's investments in new lighting, heating, cooling, motors, and clean industrial technologies offer hard-to-beat returns on taxpayer dollars. A DOE study found that a 10–20 percent decrease in waste by U.S. industry would, by freeing up money for more productive investment, generate 2 million new jobs—not even counting the jobs created by capturing the growing export market for clean technologies.

While some in Congress have seen the energy efficiency program as having only an environmental justification, it has far greater benefits to U.S. economic growth and business competitiveness by lowering costs and increasing productivity. That's a key reason the previous Republican administration steadily increased the program's budget, a trend this administration has continued. Bipartisan support of lean and clean investment is essential if the U.S. economy is to enjoy a continually rising quality of life. ■

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