

# Energy Efficiency How-Tos

BY DAVID RUCKER AND J.D. CUNNINGHAM

## Practical ways to cut down on waste

**E**ffective businesspeople are lowering their company's environmental impact, increasing efficiency, and reducing the costs of natural resource usage throughout their operations. Building on lean six sigma manufacturing and process management methodologies, these professionals are discovering new ways to reduce the carbon impact of their products and processes and create truly lean and green businesses.

The constraints and costs of natural resource usage are rising at an alarming rate. They have a significant impact on business operations and financial performance. In addition, company leaders are coming under increasing pressure from governments, advocacy groups, investors, prospective employees, and consumers to make operations, products, and services more socially responsible—particularly as pertains to the environment. Additionally, heavy polluters, such as utilities, should anticipate climate regulations in the next five years.

The U.S. Department of Labor reports crude energy costs were up 85 percent in 2007. These extremely high levels are forcing company decision makers to make their organizations much more efficient. However, there are other reasons to reduce greenhouse gas emissions and undertake corporate social responsibility initiatives. Business leaders acknowledge the advantages that come from proactively addressing corporate social responsibility issues. In fact, a recent survey of more than 250 senior executives showed that 68 percent already are focusing on corporate social

responsibility activities in order to create new revenue streams, and 54 percent believe this gives them a competitive advantage.



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There's a fundamental truth to understanding and improving any aspect of your company's performance: If you can't measure it, you can't manage it. This applies as much to an organization's energy and water consumption as it does to anything else—and lean six sigma can help professionals apply this principle and make their businesses greener.

Lean six sigma tools provide a standard approach to improve energy efficiency and measure performance. For example, by collecting a detailed account of the company's natural resource usage, managers at IBM recently were able to significantly reduce consumption. Tracking usage numbers and taking conservation measures saved \$310 million. One part of the project involved a work-at-home program that eliminated 8 million gallons of gasoline consumed by employees in company cars. Additional real-world energy-reduction case studies follow.

### **Electricity reductions in the real world**

Executives at an Iowa-based aluminum sheet producer focused a kaizen improvement team on electricity consumption, which amounted to half of the company's total utility spend. The team members dug in and quickly assessed that motors and chillers each accounted for 25 percent of the electricity usage, with air compressors following at 15 percent. This information focused the team as they performed "waste

walks,” hunting for conservation opportunities throughout the facility.

The improvement team uncovered more than 50 air leaks in one department alone, super-heated steam unnecessarily vented, and an excess of outside office trailers. In addition, they found a motor repair program that had historically favored cheaper replacement parts over efficiency and now was out of balance with increased energy costs. By removing unnecessary trailers, revamping the motor repair policy to increase efficiency, modifying ambient air settings, and repairing air leaks, the team generated \$114,000 savings—in a single week. These results are typical of the kaizen process.

### Less steam ahead

A continuous-process polyester fiber plant located in the Southeastern United States applied lean six sigma tools to reduce steam consumption. Improvement team members began by drawing a map of the entire steam system. Next, they traced the steam systems and the high-pressure superheated loops and their returns and collection traps, stopping along the way to take photographs of the most urgent leaks. During this investigation, many leaks were discovered that had been hidden by system modifications dating back decades.

The team also found steam spilling out from traps that had been plumbed outside buildings to prevent heating up internal areas. It appeared that some of the plumbing abnormalities were intended to be temporary solutions; however, over the years, they had been forgotten. One return was dumping more than 50 gallons per minute.

On the third day of the improvement initiative, team members implemented changes that would eliminate leaks, repacked valves, repaired condensate returns, and replaced a steam trap. They also labeled condensate returns with new signs detailing what actions to take if hot condensate or steam were seen relieving from an overflow anytime in the future. A savings of \$56,000 was gained almost immediately, and another \$183,000 was identified as team members continued to stop leaks and repair steam traps.

### Cutting back on material waste

A leading manufacturer of tissue products located in upstate New York had to periodically stop large, continuous-processing equipment in order to purge all material and clean the vessels, reactors, and interconnecting piping before restarting the system. Company leaders had conducted several studies and improvement initiatives that attempted

to help them lower the equipment downtime associated with these cleaning cycles, but they had never focused on the associated material waste.

Material waste was incurred during product changeovers, flushing and cleaning cycles, and preventive maintenance. If the materials were toxic or required special handling, storage, or disposal, the cost of removal would escalate quickly.

Recently, an improvement team devised a better method of cleaning the complex series of reactors, which produced 6,000 fewer pounds of material waste per cycle. They accomplished this by implementing pagers to increase

the speed of communication among the multiple departments involved in the cleaning process. As a result, employees were able to synchronize material flow cutoffs.

Soon after, a thorough analysis indicated a potential to stagger reactor shutdowns such that more labor could be focused on one reactor at a time, reducing overall waste. The team established standards for all settings, pump speeds, and any operator-controlled variable that affected the amount of material waste generated.

Finally, a detailed tracking system was put in place to ensure the new processes were followed and intended efficiencies achieved.



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### Tools for progress

Kaizen improvement team members can locate and address energy issues just as effectively as they can identify traditional improvement activities, such as increasing productivity. You don't need to be an expert to make significant improvements. Typically, there are many opportunities that can be readily addressed without spending significant capital funds.

Begin by gathering the monthly utility bills and charting energy consumption broken out by major utilities—water; heating; cooling; electricity; steam; oil; gas; and, depending on your environment, nitrogen or other chemicals. To create a manageable scope for a kaizen team, select one of these energy streams and, if necessary, further hone the scope to a subcategory, such as electricity that is being used to generate compressed air. Then, apply the lean tools you already use elsewhere in your business to reduce consumption of this energy.

Next, build a process map of where the energy stream is consumed and how much is used. You may find that the available data broadly track energy usage across a range of processes or buildings, making it tricky to isolate high users and equally difficult to track savings results.

Frequently, energy usage data-collection systems are outdated relative to the current costs of energy. In these situations, the improvement team should develop recommendations for a more extensive data-collection system to help identify future improvement projects and track sustainment of the work.

To assess the extent of the opportunity, calculate the theoretical energy usage for the area of focus versus the actual usage. Then, send out team members to observe first-hand how the resources are being consumed and identify energy-saving opportunities. Brainstorm all possible ideas to achieve more sustainable operations. After that, group and select the largest-impact ideas with relative ease of implementation. Keep in mind:

- A single compressed air leak can cost \$12,000 a year. It is not uncommon to discover up to 50 percent of your compressed air lost through leaks.
- A failed steam trap also costs about \$12,000 a year.
- Motors account for 60 percent of industrial electricity. Revamping motor and starter maintenance procedures can yield up to 20 percent in energy savings. Even staggering motor starts can help.
- Steam generation accounts for 45 percent of all fuel burned in the United States. Good preventive maintenance procedures—such as minimizing boiler blowdown, returning blowdown condensate, minimizing trap losses,

insulating heaters and primary piping—can substantially reduce steam consumption.

To aid the team members in their discovery process, consider providing them with some very useful tools. For example, having an ultraprobe and infrared gun on hand can help them identify sources of leaks. These devices are portable, easy to use, and—best of all—they don't require equipment downtime. You will be surprised at the long list of leaks, unnecessarily running energy streams, and other sources of waste identified by team members.

Once initiatives are set in motion, energy savings will compound day after day, week after week, and month after month. To realize even more benefits from your continuous-improvement efforts, make sure to keep targeting improvement areas that normally might be overlooked. Applying sustainability principles to all areas of an operation will result in dramatic bottom-line results. 

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