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Seizing China's energy-efficiency opportunity: A case study

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Improving energy efficiency in industrial environments starts with changing minds—not machinery. The progress made by one of China's largest state-owned enterprises holds lessons for industrial players of all stripes.

Energy efficiency and conservation have rocketed up China's corporate agenda, particularly for heavy-industry players such as power plants, steelmakers, chemical companies, and automakers. Energy is the largest expense for some of these industries, and since variable costs represent a larger share of total costs in China than in more developed countries, where fixed labor outlays are higher, volatile commodity prices hit China's core industrials much harder. These economic fundamentals apply to multinationals and local players alike, so efforts to secure the benefits of improved energy efficiency are important for a wide cross-section of companies.

Yet achieving those benefits is difficult. The tendency at most industrial companies, and not just in China, is to equate energy savings with capital expenditures, hardware, and other technical solutions. Actually, what is often most important to change is poor cooperation and unhelpful mind-sets prevalent on the front line. Similarly, many companies in China and elsewhere lack an integrated view of how energy yields, energy output, and energy consumption combine to affect their operations. Some measure these factors only in a superficial way.

Nonetheless, a few of China's leading industrial players are making impressive headway. In this article, we'll look at one such company—a large resource- and emission-intensive Chinese state-owned enterprise—that in the wake of the global financial crisis began rolling out a series of energy-efficiency improvements across its plant network. A closer look at the company's flagship plant, where energy consumption fell by more than 10 percent, offers insights for other industrial groups, in China and beyond, as they seek ways to lower costs and use energy resources more wisely.

Welcome to the downturn

As consumer demand plummeted at the start of the global economic downturn, the company's leaders watched as prices for its goods fell by more than 50 percent in a matter of weeks. Within four months, the group's record figure for profits was followed by a comparable loss.

To stanch the bleeding, the company's leaders launched an aggressive operational-improvement effort. To no one's surprise, energy efficiency appeared the likeliest starting place—after all, energy was the biggest cost driver, representing half of a plant's variable costs and about 40 percent of the total. Personnel costs, by contrast, were less than 8 percent of the total. Only by improving energy efficiency, the leaders believed, could the company hope to regain profitability and put its operations on a more solid footing.

'Energy is free'

The team of company experts these executives assembled to assess the situation faced an immediate hurdle: no one at the plant level was responsible for tracking energy in the necessary detail. Even at the group level, the company had little visibility into the way energy consumption, yields, and output combined to affect the economics or operations of plants. At the company's flagship facility, only one employee worked on energy-related issues—part time—and he focused on basic monitoring and on collecting data for government-reporting purposes, not on efficiency improvements.

This state-owned company's inattention to energy efficiency is far from unusual in China, and far more common in industrial environments around the world than you might expect. The reason is that the costs associated with energy use often are felt, if they are felt at all, far from the factory floor, where energy is consumed. Most of the Chinese company's line workers thought of energy as "free," when they bothered to think of it—a sentiment we hear across shop floors around the world. At this company, that mind-set encouraged well-meaning yet shortsighted activities. On the front line, for example, workers used compressed air to cool down motors and extend their operating lives, although on an annualized basis the compressed air cost several times more than a new motor.

As company experts began to work closely with leaders at the flagship plant to gather data and identify opportunities, they quickly encountered another mind-set challenge common to operational-improvement settings: complacency. The leaders of the plant knew full well that it was the pride of the group, and many believed that its efficiency approached or matched global standards on some measures. Only a few percentage points of improvement were possible, many thought, and new equipment would be needed to realize energy-efficiency gains. This attitude was shared throughout the plant. "We thought we were already the best in China," said one worker. "We were running at our technical limits," said another.

Wake-up calls

Two events began turning the tide. First, a benchmarking effort showed that the flagship plant was squarely in the middle of the pack when ranked against global competitors. The company's best wasn't good enough.

Second, the company's CEO decided to pay a surprise visit to the facility. He recognized that seizing energy-efficiency opportunities would require determination and a new way of thinking about operations and wanted to see the starting point first hand. He also hoped to send a clear signal—to plant leaders and workers alike—that he was serious about change.

Leaving his company car and driver at his hotel to avoid tipping off the plant's staff, the CEO set out with two others in a private car late one evening to observe the night shift. After spending nearly 20 minutes locating a supervisor in the guts of the vast plant, the CEO was dismayed to find no one working in an area of its coal-gasification¹ unit where employees should have been making energy-saving temperature adjustments. Instead, these workers were visiting with colleagues in a control room. One detail illustrated the lack of seriousness some of them showed in approaching the energy challenge: a maintenance checklist bore a signature indicating that an inspection had been completed at 5 AM the following morning. It was not quite midnight.

A similar visit later that week to a nearby satellite facility, while not as dramatic as the first one, also drove home the need for change. A week later, the CEO announced a wholesale replacement of the plant's leadership, in an effort to impose the management discipline needed for energy-efficiency efforts.

Getting down to business

Following these wake-up calls, managers and workers began buckling down. In the plant's coal-gasification unit, for example, the company rationalized the way coal was transported and stored. Coal begins to oxidize and degrade as soon as it's mined, but through better handling and a straightforward "first in, first out" system, the company improved the energy yield of its coal significantly.

Meanwhile, a better screening system ensured that coal particles were more uniform in size, which improved the efficiency of gasification. Finally, better management and tracking in the coal yard helped the company reduce inventory from 20 days to 10. All told, these changes—plus comparable moves to make the boilers, turbines, and other steam-related equipment more efficient—helped reduce costs in this area by 13 percent (and by 7 percent in the first month alone).

¹Coal gasification is a common process, used in heavy-industry settings such as chemicals, steelmaking, and oil refining, to extract fuel energy from coal.

The company launched similar efforts to improve the efficiency of motors, pumps, and other equipment vital to plant operations. Like the changes to the steam-related processes, most of these improvements will require little in the way of capital investment. To date, company executives have identified a potential 15 percent improvement in this area and expect to fully achieve (or exceed) it within 12 months.

Measure, then manage

To help ensure that the changes would stick, the company implemented rigorous data-gathering and performance-management systems alongside the operational changes. Earlier, it hadn't measured energy use in any of the plant's large operational processes. Today it measures all of them. Improved tracking and straightforward shop-floor *kanbans* (signboards that help workers visualize work flow and trigger activities that enhance fast responses) help workers monitor temperatures, processes, and tolerances to maximize energy efficiency. The plant also conducts "theoretical limit" analyses to see what best performance looks like—an exercise that lets workers determine where and how to focus and quantify their efforts.

Efficiency targets are now tied to the performance appraisals of plant managers. Similarly, managers and workers who have direct control over underlying factors that drive energy efficiency—say, the operating temperature of a mechanical process—are assigned as "owners," with direct responsibility for meeting targets. Daily performance dialogues help workers keep on track while giving them a forum to identify, discuss, and solve problems in a timely manner. Moreover, by carefully defining, sequencing, and weighting the targets at the plant and individual shop-floor levels, the company keeps frontline workers focused on the underlying factors that influence the efficiency of the process or activity at hand. This approach also ensures that these workers' specific areas contribute to the plant's big-picture energy-efficiency goals.

Meanwhile, at the corporate level, the company created a new organization, headed by a group vice president, that is responsible for energy efficiency. Assistant managers in each of the company's plants work closely with specialists in the most energy-intensive

divisions to monitor progress and suggest improvements. Some of these ideas have come from the shop floor, where workers now have a much clearer idea of how their actions influence energy use. Collaboration is also improved. As one vice department manager put it, “We have established much closer communication and cooperation between departments and plants along the energy value chain.”

The initial wave of results was encouraging, and changes continue to be rolled out at the flagship and other plants. After the first year, the flagship had exceeded its overall target, lowering its energy consumption by 12 percent and saving some 200 million renminbi (about \$32 million). A second wave of energy-efficiency improvements, under way now, is expected to generate additional savings. Subsequent benchmarking found that the flagship plant is poised to become one of the world’s ten most energy-efficient facilities of its kind—a goal the company’s leaders expect to achieve in the near future. They now see energy efficiency as the biggest lever for boosting profits. Indeed, it is expected to contribute a majority of the operational-improvement gains the company has identified this year across its whole network of plants. These gains are projected to exceed those achieved at the flagship plant by more than a factor of ten. ○

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