

A Four-Step Path

to a Comprehensive Energy Management Action Plan

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-and-

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Industry consumption contributes to greenhouse gas emissions

Industry consumes 33 percent of energy¹ and creates 29 percent of greenhouse gas emissions², exceeding the energy consumption and greenhouse gas emissions for all transportation and building types in the United States. From a bottom line perspective, energy costs are often the single largest controllable facility operating expense and exceed ten percent of gross profits for more than a quarter of manufacturers³. Clearly, industry's continued improvement in energy efficiency is essential if the US is to make progress toward energy independence and reduce global greenhouse gas emissions, and if US manufacturers want to remain competitive in global markets.

How should industrial facility managers drive these improvements? There seem to be as many opinions about what should comprise an effective strategic energy management approach as there are industrial facilities in the US.

Consider the following comments from industrial facility personnel taken during a recent survey conducted by Schneider Electric and *Plant Engineering* magazine regarding energy management solutions and strategies in industrial facilities⁴:

- *"ALL planning must involve every phase and every level of our business, from management to floor-level personnel, as well as asset management."*
- *"Efficient use of energy, raw materials, capital assets and personnel. A sustainable manufacturing plan requires attention to every area impacting the operation."*
- *"If a single area is not maintained, it will likely result in the failure of the complete operation."*

The majority of industrial facility personnel surveyed view energy management as a necessary and perhaps crucial component to a company's overall health. However, the survey also shows that those opinions have not been embraced by most manufacturing organizations, which suggests a change in mindset is necessary from corporate management to the plant floor. Though commitments of time and budget are necessary, the only way to ensure both are utilized effectively is a comprehensive energy management action plan with mechanisms in place to ensure both energy usage accountability and long-term improvement.

Defining terminology

It is important to establish a common understanding of energy management vernacular at the onset of any corporate energy management project. There are often basic terminologies that, though similar, have fine shades of meaning that make their usage less interchangeable.

Energy efficiency is the action of lowering energy demand by reducing ongoing energy usage. Conversely, **sustainability** is the practice of ensuring long-term business viability by reducing environmental impact and managing scarce resources in a manner that does not compromise profitability. Finally, a **comprehensive energy action plan** is an energy management roadmap that includes accountability for energy efficiency improvement to manage costs and usually incorporates green initiatives related to sustainability goals. The most effective energy management action plan is comprised of four key steps, which will be explored further:

1. Measure energy usage
2. Fix the basics
3. Automate
4. Monitor and control



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1 Source: U.S. Department of Energy (DOE) Energy Efficiency and Renewable Energy Building Energy Data Book 2006.

2 US Environmental Protection Agency (EPA) Greenhouse Gas Inventory Report 2007.

3 US Census Bureau 2007 Economic Census

4 For more information about the survey, see the sidebar titled Methodology.

The most effective energy management action plan is comprised of four key steps:

- 1) Measure energy usage
- 2) Fix the basics
- 3) Automate
- 4) Monitor and control



Passive Energy Efficiency is the use of basic energy efficiency devices and materials. Typical measures include energy efficient light bulbs or motors, improving a plant's power factor, fixing compressed air leaks, and installing better insulation and windows. **Active Energy Efficiency** is implementing permanent change through measurement, monitoring and control of energy usage. Many of the systems that consume energy can utilize automated controls to optimize energy and help ensure that cost savings don't erode over time.

Areas of disconnect

The survey left no doubt that energy management and sustainable manufacturing practices are among the most prominent areas of interest for industrial facility personnel. When asked if it was important for their company to follow sustainable manufacturing practices, 68 percent of surveyed plant managers, plant engineers, facilities managers and maintenance engineers considered it "Extremely Important" or "Very Important." However, there was little consensus on how to achieve energy management goals, or what those goals should be – just 27 percent of those surveyed consider themselves "Extremely Knowledgeable" or "Very Knowledgeable" about manufacturing sustainability.

In addition, there appears to be no clear-cut level of responsibility for energy management decisions in industrial facilities. When asked who was responsible for energy cost reduction at their facility, 54 percent indicated the operations manager, 46 percent indicated the manufacturing or process engineer, 45 percent said it was the facility manager and just 30 percent said it was corporate management. These figures stand in contrast to the overall corporate direction on energy-related issues – 41 percent noted it was a corporate philosophy, while just 23 percent said their facility had a formal energy plan and 25 percent said neither.

There is no doubt industrial facilities have a renewed focus on energy efficiency, if for no other reason than to cut costs. Consider the following comments from the survey:

- *"There was no past drive to reduce costs. Now with production reduction there is a movement to cut energy costs."*
- *"Shrinking budgets force us to continually evaluate our operation to increase efficiency."*

But it would not appear that cutting costs has translated to a strategic energy approach:

- *"There is a corporate plan and philosophy but where the rubber meets the road, there isn't a real plan. We save as long as it doesn't require any funding. [For] example: turn lights off, turn HVAC temp down."*

Despite the very low risk associated with most energy cost-reduction programs, organizations tend to fund only those projects with very short payback periods. More than 43 percent of those surveyed said their organization expects a return on investment within one year on energy efficiency improvements, while another 26 percent indicated their firm would approve projects with a two-year simple payback period. Only 14 percent of respondents indicated their organization would fund energy-efficiency improvements with a payback longer than three years.



Organizations tend to fund only those projects with very short payback periods

A four-step path to improvement

Companies with specific energy management goals, clear accountability and employee awareness and training are best-positioned for success. Most manufacturers are addressing the two technologies generally viewed as having the potential for the quickest energy savings and return on investment – lighting and motors. More than 50 percent of those surveyed have already installed high-efficiency lighting and motors; more than 62 percent control their motors with variable-speed drives or soft starts; and 47 percent have a lighting control system in place. Environmental control systems also are popular choices as 40 percent use a building automation system to manage their plant's HVAC.

Survey respondents also realize that many affordable technologies are available today to significantly reduce energy consumption and increase savings:

- *“Technologies change daily and many advances are available at any point in time.”*
- *“We were working on energy savings in HVAC systems and compressed air already. The slowdown in business has allowed us time to focus on smaller projects such as motion detection for lights in offices, etc. I am also looking for ideas in passive lighting systems.”*

The US Environmental Protection Agency's ENERGY STAR® program suggests a continuous improvement approach to energy management⁵. After an initial assessment, it recommends companies create and implement an action plan, evaluate progress, recognize achievements, and then reassess and set new improvement goals.

Survey results indicate that those manufacturers who place a high priority on sustainability most consistently implement all phases of Schneider Electric's recommended four-step process for continuous energy efficiency improvement, which should be the cornerstone for a comprehensive energy management plan:

1. **Measure energy usage:** A comprehensive energy analysis, consisting of collecting data from major energy consumers within a facility, examining energy usage patterns and demands, and evaluating their impact on total energy consumption, is a key component in identifying improvement opportunities. Installing power metering and monitoring is important to track and provide a baseline for energy usage.
2. **Fix the basics:** Typically the only tactic addressed by industrial facility management in the wake of an energy audit or similar study, fixing the basics is comprised of implementing passive energy efficiency measures like high-efficiency lighting, HVAC systems, motors and capacitors (if required to improve the power factor).
3. **Automate:** Installing active energy management measures promotes ongoing energy efficiency improvements and helps maintain and improve energy and cost savings over time. For example, measures like schedule-based lighting control and occupancy sensors automatically turn lights on only when they are needed, while HVAC control regulates heating and cooling at optimal levels, which can change frequently.
4. **Monitor and control:** Managing key energy demands and modifying employee behavior drives continuous improvement through information, training and management review, and helps ensure that initial energy and cost savings don't erode over time. Power meter installations, monitoring services, energy efficiency analysis, energy bill verification and an enterprise energy management (EEM) system all can help achieve this end.

5 See U.S. Environmental Protection Agency ENERGY STAR® Building Upgrade Manual at http://www.energystar.gov/ia/business/EPA_BUM_CH1_Intro.pdf

Passive vs. active energy efficiency measures

High-efficiency lighting	Lighting control, occupancy sensors
Energy-efficient motors	Variable speed drives on motors
High-efficiency boilers	Software and metering to track energy usage to key loads or processes
High-efficiency HVAC equipment	Building automation system to control HVAC
Energy efficiency of key manufacturing processes	Enterprise energy management (EEM) system

Manufacturers who place a high priority on sustainability are far more likely to implement both passive and active actions to improve energy efficiency – key tenets in a comprehensive energy management action plan. According to the survey, these manufacturers were more likely to improve energy efficiency with passive measures like building insulation, implementing high-efficiency lighting and HVAC equipment, and energy-efficient motors.

Over half (53%) of companies with this priority have also installed lighting controls, compared to 30 percent of companies where sustainability is not a priority.

Crafting an effective plan

Due to rising energy costs and the value of being viewed as a good environmental steward, sound energy management and sustainable manufacturing practices cut straight to the manufacturing bottom line. Typically, plant management — from the corner office to the plant floor — realize the importance of energy management and implement many of the basic cost-cutting strategies, such as energy audits and passive energy efficiency measures.

In many cases, though, they are not leveraging the full complement of opportunities that are at their disposal. While a greater global demand for energy has brought energy management and sustainability policy and practice into sharper focus, time and capital budget are at a premium. A comprehensive energy management action plan, utilizing the four-step process described previously and incorporating both passive and active energy efficiency measures, can help secure managerial commitments making energy management part of a plant's operational procedure regardless of external trends.

Summary

Effective energy management requires a greater awareness of and commitment to the issues surrounding energy efficiency and sustainability. Sustainable manufacturing requires a commitment to more sophisticated energy management equipment and training in the coming years, such as energy monitoring, building and process automation equipment, and active energy efficiency measures for controlling and optimizing energy use. The best strategy is to ensure all tactics are part of a well-thought energy management action plan.

About the Authors

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Methodology

This study was conducted by Reed Business Information's Boston Division Research group on behalf of Schneider Electric to evaluate energy management solutions and strategies among plant engineers.

The study evaluates:

- The impact of the economy on plans to achieve sustainable manufacturing strategy
- Job functions involved in energy cost reduction plans
- Company's energy management philosophies and strategies
- The importance of sustainable goals to organization
- Elements of importance in sustainable manufacturing plans
- The importance of sustainable solutions today and past three years
- Actions taken to improve energy efficiencies and reduce energy costs
- Time to recoup energy-savings investments
- Solutions yielding greatest savings
- Where meters are installed to monitor energy usage
- Demographics: Square footage of location, 2008 energy expenditures, company's revenue, job title

Subscribers of *Plant Engineering* magazine were sent e-mails on April 15 and 17, 2009, requesting their participation in this study. All respondents were qualified as decision makers in their operations for energy management solutions and strategies. The e-mail included a URL linked to the questionnaire.

Results of this study are based on 435 usable responses. At a 95 percent confidence level, results are projectable at a margin of error of plus or minus 4.7 percent.

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