A Glimpse at What's Between the Covers of the Market Assessment

Industrial Motor Systems are the Largest Single Electrical End Use

In 1994, motor systems used only for production processes consumed 679 billion kWh or 23% of all electricity sold in the United States that year. Add the energy associated with industrial heating, ventilation, and air conditioning systems, and the total jumps to 747 billion kWh or 25% of all electric sales.

In U.S. industry, process motor systems account for 63% of electricity use; HVAC motor systems account for 6%. Therefore, all types of motor systems account for 69% of all industrial electricity consumption.

Save More than 10% with Motor System Improvements

It's time to take advantage of the opportunities for motor system improvements in your manufacturing facility. According to data collected during the Market Assessment survey, potential motor system energy savings across all U.S. manufacturing using mature, proven, cost-effective technologies range from 11% to 18% of current annual motor system energy use or 75 to 122 billion kWh per year. In dollar figures, the savings amount to $3.6 billion to $5.8 billion annually. For some specific facilities and systems, Motor Challenge, through its Showcase Demonstration case studies, has documented savings of 33% to 59%, far exceeding the industry average.

The following table shows how potential savings are distributed among different kinds of measures and end uses in manufacturing only. Nearly two-thirds of all potential savings derive from system improvements, such as substituting adjustable speed drives for throttling valves or bypass loops in pumping systems and fixing leaks in compressed air systems. Improvements to major industrial fluid systems—pumps, fans, and air compressors—present up to 62% of all potential savings.

In addition to energy savings, improvements result in many economic benefits such as increased control over manufacturing processes and improved quality control.

Summary of Motor Energy Savings Opportunities by Measure in Manufacturing Facilities

Measure	GWh	Percent of Total Motor System Energy
Motor Efficiency Upgrades	24,577	4.3%
Systems Level Efficiency Measures Correct Motor Oversizing	6,786	1.2%
Pump Systems: System Efficiency Improvements Speed Controls Total	 13,698 14,982 28,681	 2.4% 2.6% 5.0%
Fan Systems: System Efficiency Improvements Speed Controls Total	 2,755 1,575 4,330	 0.5% 0.3% 0.8%

Compressed air systems:		
System Efficiency Improvements	13,248	2.3%
Speed Controls	2,276	0.4%
Total	15,524	2.7%
Specialized systems: Total	5,259	0.9%
Total System Improvements	60,579	10.5%
Total Potential Savings	85,157	14.8%

Motor System Energy Use and Savings is Highly Concentrated in 10 Industries—Is Yours One of Them?

Ten industries (paper mills; petroleum refining; industrial inorganic chemicals; paperboard mills; blast furnace and steel mills; industrial organic chemicals; industrial gases; plastics materials & resins; cement, hydraulic; and pulp mills) account for nearly half of all manufacturing motor system energy use and half of all potential motor system energy savings. They include only 3583 facilities or 1.5% of all manufacturing plants. In all these industries, the annual cost of motor system energy in a typical plant exceeds $1 million. In steel mills, for example, the cost is $6 million. Because these industries use large amounts of motor system energy, they also have the opportunity to achieve large energy savings. Potential savings range from $90,000 annually in the industrial organic chemicals sector to nearly $1 million annually in petroleum refineries.

What does all this mean for your company's bottom line?

The process industries listed here operate on very thin margins. In 1996, the operating margins for these groups were around 16%, so even relatively small increases in operating margin can significantly impact profitability.

Take the Systems Approach to Energy Efficiency and Save

Over the last 5 years, industrial engineers and plant managers have begun to formulate and articulate a systematic approach to achieving energy efficiency in motor systems. Motor Challenge has joined forces with electric utilities, trade and professional organizations, and government agencies to promote this approach. The systems approach can be broken down into three elements:

- system performance optimization
- efficient components selection
- operation and maintenance practices

Turn to the Market Assessment for examples of the systems approach to efficiency measures in pump, fan, and compressed air systems. Here's an example of what you'll find.

Energy Saving Opportunities in Pump Systems

Equipment Group/Efficiency Measure	**Savings (Percent of System Energy)**
Process System Design Reduce Overall System Requirements	

- Equalize flow over production cycle using holding tanks. - Eliminate bypass loops and other unnecessary flows. - Increase piping diameter to reduce friction. - Reduce safety margins in design system capacity. Match Pump Size to Load - Install parallel systems for highly variable loads. Reduce or Control Pump Speed - Reduce speed for fixed loads; trim impeller, lower gear ratios. - Replace throttling valves with speed controls to meet variable loads.	10%-20%* 10%-20% † 5%-20% † 5%-10%† 10%-30%† 5%-40%† 5%-50%†
Component Purchase - Replace typical pump with efficient model. - Replace belt drives with direct coupling. - Replace typical motor with most efficient model	 1%-2% About 1% 1%-3%
Operation and Maintenance - Replace worn impellers, especially in caustic or semi-solid applications.	 1%-5%

Findings on Current Motor Systems Design, Purchase, and Maintenance Practices

- Most motor purchase designs are made at the plant level.
- Only 19% of respondents reported being aware of "premium efficiency" motors, the common market designation for motors that meet standards promulgated in the Energy Policy Act. Only 4% of customers reported understanding the efficiency ratings associated with the premium or high efficiency designations, whereas 38% reported being somewhat aware of these relationships.
- Only 22% of customers surveyed reported that they had purchased efficient motors in the past year.
- Customers most often use the size of a failed motor being replaced as a key factor in deciding the size of the new motor. And 29% use the size of the failed motor as the only factor in the sizing decision. This practice can lead to persistent oversizing of motors, which leads to inefficient operations.
- Only 11% of customers interviewed reported having written specifications for motor purchases, and only two-thirds of those customers included efficiency in their specifications.
- Reducing capital costs is the most important consideration driving customers' decision whether to rewind or replace failed motors.
- The frequency with which system-level improvements are undertaken is low, except among the largest facilities.