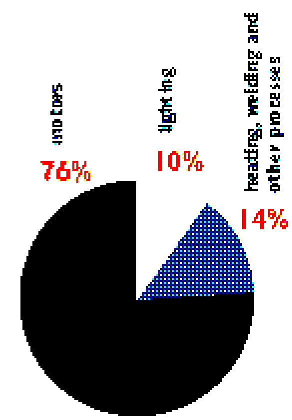
EFFICIENT MOTOR SYSTEMS MANAGEMENT

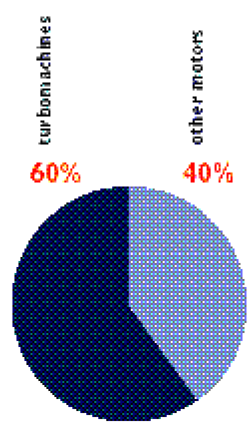
Efficient motor systems make a significant contribution to your bottom line.

Motor systems consume more than 75% of a plant's electricity. Motors operate all types of process equipment and have a direct effect on your operation's productivity and product quality. Improved energy efficiency helps your business lower operating costs and be more productive. It makes good business sense to consider energy efficiency in the design and selection of equipment. Often, improving the efficiency of a motor system will uncover solutions to a number of production and maintenance problems. A motor system is defined as including all the components from the initial energy input to the final process use. Energy use defined in this manner reflects the power consumed per unit of product produced. Management of the motor system involves maximizing the value of capital assets and minimizing operating costs, while maintaining efficient and reliable production output. Effective motor system management develops synergies between preventive and predictive maintenance programs, equipment operation and process productivity to establish a repair/replace policy based on a commitment to energy-efficient equipment selection and operation.

Typically, the value derived from these benefits are more significant than the energy cost savings. Benefits can be obtained in the areas of productivity, reliability and cost reduction.

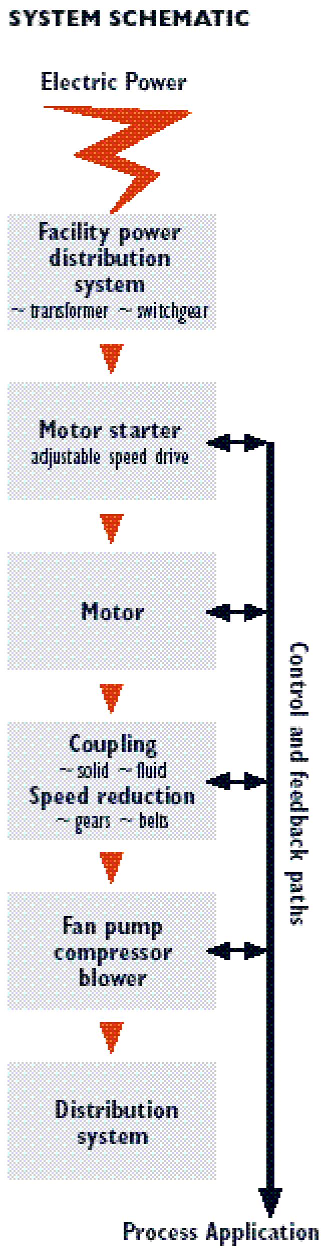


DISTRIBUTION OF INDUSTRIAL ELECTRICAL USE



TURBOMACHINES INCLUDE FANS, PUMPS AND COMPRESSORS

INCREASED PRODUCTIVITY	IMPROVED RELIABILITY	REDUCED COSTS
Greater control over process requirements	Scheduled downtime instead of breakdown maintenance	More efficient operation
Flexibility in meeting production requirements	Longer production runs between maintenance outages	Reduced maintenance costs
Reduced scrap and rework	Longer equipment life	Lower unit cost



ELEMENTS OF A MOTOR SYSTEM

Motor systems involve a number of components, as shown below. In every facility a number of systems can be identified, such as ventilation, process heating, refrigeration, boiler combustion air and compressed air systems. Common elements in all systems include power input, energy conversion equipment, control mechanisms and valued output meeting process demands. The systems approach accurately and efficiently matches system output to industrial process requirements. This guide focuses on systems that consume most of the energy used in industry. These applications use fans, pumps and compressors to provide resources that meet specific performance requirements, which are necessary in order to keep productivity high.

APPLICATION	RESOURCE	PERFORMANCE REQUIREMENTS
Operate air-driven equipment	Compressed air	Adequate flow and pressure
Process temperature control	Hot or cold liquids/gases	Temperature differential, flow
Material handling, mixing	Fluid flow – liquid/gas	Maintain volume flow
Machine drives, conveyors	Motive power	Process-dependent speed/torque
Hydraulic power	Pressurized fluid	Adequate pressure and flow
Heating and ventilation	Airflow	Maintain volume flow

ECONOMIC CONSIDERATIONS

Life-cycle analysis can reveal new opportunities to increase profits.

The energy consumed in your operation's motor systems directly affect your bottom line profit. Motor systems affect both variable and fixed costs. Although energy costs may not be a high percentage of your product cost, any reduction in these costs will increase your profit margin. For example, if your profit is 10% and electricity averages 4% of your product cost, then a 25% reduction in energy costs represents a 10% increase in profit at the same sales volume. First cost versus life-cycle cost must be examined for each process application.

Energy costs over the life of a motor or system are often many times the initial incremental cost of purchasing high-efficiency equipment. An estimate of the annual dollar value resulting from improved reliability, reduced downtime, lower operating costs and increased productivity should be included in any financial calculation. These benefits are often more valuable than the energy savings alone and should be considered when evaluating different energy-efficient solutions. Comparisons are often simplified on the basis of:

- the incremental cost is the premium paid over that of a lower efficiency component and should be used when a component is scheduled to be replaced; and

- the total purchase cost less the cost to rebuild the existing equipment to “as new condition” is often used when considering immediate replacement of a functioning piece of equipment.

Industrial equipment remains in service for a long time. With good maintenance a large motor (including rewinds) can last up to 25 years before it is replaced. Careful consideration for the selection of energy-efficient equipment should be made when evaluating new purchases to avoid losing these opportunities for efficient operation.

The most common methods to compare projects are:

- Simple payback = cost of implementation ÷ average annual savings

- Net present value = calculation of value in present dollars of costs and savings over the life of the equipment. The value of the savings should be greater than the dollars invested.

- Internal rate of return = percentage return from savings compared to the cost of implementation. The percentage of return should be higher than the company’s internal hurdle rate.

Determine which method is used by your company. Capital cost allowances and accelerated depreciation may further reduce the payback of energy-efficient equipment purchases.

When calculating electrical energy savings, be sure to include both demand and energy savings. The incremental cost of power should be used to calculate the payback from energy savings. The cost of power can be determined from your utility bill or rate card. Allocation of costs should be calculated on an average energy cost basis, by dividing total use by total energy cost. Savings from time-of-use rates and change-of-rate class should also be considered.

PRIORITIZING SYSTEM EVALUATION

Matching system capabilities with production requirements will yield remarkable rewards.
The system approach accurately matches system flow and pressure output to process requirements. This approach can obtain energy savings of 20% to 50% compared with savings of 3% to 15% with component efficiency improvements. Various technical, operational and financial issues will need to be addressed. To get started, identify the people in your company’s purchasing, maintenance, operations and planning departments who are responsible for ensuring that the plant operates smoothly. These people will need to work together and understand that all their departments can benefit.

In facilities that have many systems, the following guide can be used to set priorities:

- start with the systems that are problematic;
- examine systems where motors or components are due for major maintenance or replacement;
- identify motors that operate at least 2000 hours per year and are over 75 hp;and
- examine systems that have blowers, pumps, fans and compressors, especially where flow is controlled by throttling devices.

The systems approach can be used to improve efficiency, and, more importantly, it can provide solutions to other problems experienced in the plant. Described below are typical responses to a common problem received from the plant floor about the lack of a plant resource, which in this case is compressed air. The principles apply to any motor system.

- Install more power: Purchase the lowest-cost 50% larger compressor or double up using the existing unit for standby and peaking conditions. This is a high initial cost option (more energy is consumed).

- Component approach: replace or repair components not meeting original equipment specifications with the same or a more efficient model. The potential for savings is 15%.

- System approach: Carefully assess the problem and determine options to eliminate it, correct any deficiencies and properly size new, efficient components to meet process demands using the lowest efficient cost option. The potential savings is 20% to 50% or more.

At one company where the machine operators complained they needed more compressed air, the response was to fix hose leaks, reduce pressure from 125 to 110 psi, install a more efficient dryer and install a larger receiver for short-term peak loads. These measures allowed the company to replace the existing compressor with a smaller-sized efficient unit, resulting in a faster payback and higher energy savings than by replacing it with a larger unit. Added benefits included a potential for savings of 40%, improved reliability, better pressure control improving product quality, lower scrap losses, increased equipment life, reduced employee frustration and better productivity since the receiver was located near the tools that required the highest pressure.

Reference:
http://oee.nrcan.gc.ca/infosource/pdfs/M92-165_1999E.pdf