ComEd's *Smart Ideas for Your Business*℠

FACT SHEET

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MOTORS

More than half of the electric energy consumed in the United States is used by electric motors.

- Electric motor systems account for almost 70 percent of manufacturing sector electricity consumption.
- A heavily used motor may cost six to ten times its purchase price to operate per year.

There's no question that focusing on motors — more efficient motors and/or advanced controllers — can be a key element of saving energy and reducing operation costs for your business.

Motor efficiency is the ratio of mechanical power output to the electrical power input, expressed as a percentage. In 1994, the National Electrical Manufacturers Association (NEMA) defined an energy-efficient motor to be one operating at 2–6 percent higher efficiency than a conventional motor. In 1997, the US Energy Policy Act (EPACT) required all motors to meet those standards. In 2001, NEMA raised the bar: premium-efficiency motors operate at 1 – 4 percent higher efficiency than the EPACT motors.

SAVING ENERGY WITH MORE EFFICIENT MOTORS

If a motor operates more than 4,000 hours a year, a one percent higher-efficiency motor is the cost-effective choice. An efficiency gain for a continuously operating 50-HP motor with a 75 percent load factor saves 4,079 kWh a year. A premium-efficiency motor will provide far more than a one percent gain.

To estimate the annual energy savings for a given motor:

Motor HP
X Load % x 0.746*
X Annual hours of use
X (100/Old % Efficiency – 100/NEMA % Efficiency)
Annual savings for a given motor

*converts horsepower to kilowatts

Example: A 20-HP 1800-rpm motor operates at a 75 percent load for 8,000 hours a year. The old motor has an efficiency rating of 88 percent; the new NEMA qualified Premium Efficiency motor operates at 93 percent efficiency.

20 X .75 x 0.746 X 8000 X (100/88 – 100/93)
= 5,469 kWh per year saved

This new 20-HP motor could be eligible for a $75 incentive from ComEd's *Smart Ideas for Your Business* program, accelerating your payback period. Incentives range from $7 for a 1-HP motor to $450 for a 200-HP motor.

Simple payback in years can be calculated as follows:

(Motor price + installation charge – incentive)
÷ Annual dollar savings
Simple payback in years

Most electric motors are designed to run at 50–100 percent of rated load. Maximum efficiency is usually near 75 percent of rated load, and efficiency decreases dramatically below about 50 percent load.[1]

Use the free MotorMaster and MotorMaster+ software available online to calculate the dollar savings and simple payback for replacing a specific motor with more efficient one. The software takes into consideration such factors as size, price, efficiency, hours of use, load factor and electricity costs.

ADDING VSDS OR VFDS TO MOTORS

Many motors operate at a constant speed all the time, regardless of load demand. When combined with an appropriate control unit, variable speed drives (VSDs) or variable frequency drives (VFDs) allow a motor's operation to be continually tuned to actual demand, resulting in considerable savings where constant speeds are not required.

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Good applications for VSDs include large motors that can operate for several hours at reduced speed and motors with loads that vary from day to night or seasonally, such as HVAC water and air flow applications. VSDs control air, water or refrigerant flow by varying the speed of the motor driving the pump or fan rather than using a valve or damper, thus ensuring that the pump or fan performs at maximum efficiency at part-load conditions.

Potential Savings from Variable Speed Drives[2]

Application	Average VSD Savings
Pumps	28 percent
Fans	28 percent
Air compressors	12 percent
Cooling compressors	12 percent
Conveyers	2 percent
Other Motors	12 percent

Using a VSD rather than a mechanical means of flow control has significant advantages. For centrifugal fans or pumps with no static lift, the fluid or air flow provided varies directly with the pump or fan rotational speed. However, the input power requirement varies as the cube or third power of the speed ratio.

If 100 percent flow requires full power, 75 percent flow theoretically requires $(0.75)^3$ = 42 percent of full power. Although this is the theoretical saving under zero static head conditions, even in practical applications a substantial energy saving can be achieved.

VSDs are often equipped with soft starting features that decrease motor starting current to about 1.5 to 2 times the operating current, dramatically reducing the impact of fan starts on an electrical system. VSDs also reduce the voltage sag that can occur when a large motor starts quickly. Voltage sags can dim lights and cause other equipment to shut down or restart.

Prescriptive and custom incentives are available from ComEd's *Smart Ideas for Your Business* program for VSDs and VFDs. VSDs installed on existing chillers, HVAC fans, HVAC pumps and package units are eligible for an incentive of $25 per horsepower for chillers and $50 per horsepower for fans and pumps. Variable frequency drives (VFDs) for compressed air system motors may be eligible for incentives of $40 per connected horsepower. VFDs for other industrial applications or for individual motors larger than 200 horsepower may be eligible for custom incentives based on kilowatt reduction.

FIVE SMART IDEAS FOR YOUR BUSINESS

1. Boost your bottom line by cutting energy costs.
2. Safeguard the environment by reducing emissions.
3. Reduce maintenance demands and related downtime.
4. Distinguish your business as a leader in saving energy and protecting the environment.
5. Use cash incentives to reduce up-front costs and shorten payback periods.

CONTACT US

For more information about ComEd's *Smart Ideas for Your Business,* visit **www.ComEd.com** or call **888-806-2273.**

[1] U.S. Department of Energy Motor Challenge. "Determining Electric Motor Load and Efficiency" fact sheet. (http://www1.eere.energy.gov/industry/bestpractices/techpubs_motors.html), 1.

[2] Wuppertal Institute. "4. Bottom up – Method 13 B: Variable Speed Drives." Presented at the Evaluation and Monitoring for the EU Directive on Energy End-Use Efficiency and Energy Services consortium's national workshops, December 2007 (evaluate-energy-savings.eu), slide #13.

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