

# Control your energy costs with variable-frequency drives

## FACT SHEET

According to the U.S. Department of Energy, motor-driven equipment accounts for 64 percent of the electricity consumed by U.S. industry. As businesses come under increasing pressure to reduce energy use and operating costs, variable-speed drives (VFDs) are emerging as a popular solution.

VFDs reduce electrical energy consumption by adjusting a motor's speed to match the required load. Many electric motors simply do not need to run at 100-percent capacity all of the time—such as those that power fans and pumps used in heating, ventilation, air-conditioning, and process-pumping applications. By outfitting these motors with VFDs, facilities can control the equipment's output to match the operation's needs, saving energy when full output is not required.

### VFD BENEFITS

With advances in microelectronics and control technology over the past 10 years, VFDs have become an efficient and reliable means of controlling motor speed. Facilities that install VFDs will use less energy, cut operating costs, and even improve process precision.

VFDs eliminate the need for expensive and energy-wasting throttling mechanisms such as control valves and outlet dampers. In addition to lowering electricity costs, VFDs reduce wear and tear on motors and related components—decreasing maintenance costs and prolonging equipment life.

A motor without a VFD operates at a constant speed. When full power isn't needed, the motor can cycle on and off frequently in an attempt to match the load. This creates unnecessary wear and reduces equipment life.



A major benefit of VFDs is their “soft-start” capability that gradually ramps up a motor's operating speed at startup and greatly reduces the stress on components. On typical startup, a constant-speed motor is subject to high torque and electrical surges that can reach up to 10 times the full current load.

VFDs can improve process efficiency and occupant comfort. For example, VFDs allow greater control of machine tool drives and processes such as water distribution, aeration, and chemical feed. In wastewater treatment plants, VFDs on aeration blowers can maintain consistent concentrations of dissolved oxygen. In heating, cooling, and ventilation (HVAC) applications, VFDs can improve occupant comfort by modulating the flow of air throughout a building.

VFDs further improve occupant comfort by reducing the noise output of fans and pumps.

### COMMON APPLICATIONS

Facilities of all kinds can benefit from VFDs—universities, hospitals, office buildings, food-processing and industrial manufacturing facilities. Virtually any application that uses motors to drive fans and pumps can find significant savings in the use of VFDs.

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Some of the most common applications for VFDs are found in the pumps and fans used for HVAC systems such as chiller-condenser water pumps, domestic-water booster pumps, air-handling fans, and cooling tower fans.

VFDs can operate on motors ranging in size from one-third horsepower (hp) up to several thousand horsepower. Energy savings are highest when VFDs are used with variable-torque loads, such as fans and pumps for HVAC purposes. The best applications are large motors that can operate for many hours at reduced speeds, such as fans for cooling towers, where loads vary from season to season and from day to night.

VFDs are not recommended for use with motors that continually operate at or near full speed, as their benefits are minimized and the VFDs themselves add a small increase to the electrical load.

### POTENTIAL SAVINGS

The steady decline in VFD cost, combined with the increase in energy savings, makes VFDs a solid long-term investment. Due to the basic nature of fan and pump operation, even a small reduction in motor speed can lead to a large reduction in horsepower and electricity consumption.

Paybacks for VFD installations are especially attractive for larger motors because the cost per horsepower often decreases with size. As a rule of thumb, adding a VFD to an applicable system costs approximately \$200 to \$500 per horsepower installed.

How much can VFDs save? Consider a 25-hp fan motor operating for 23 hours a day. It's unlikely the fan operates at 100-percent capacity for the full 23 hours. If the unit actually runs at full capacity for only two hours, 75-percent capacity for eight hours, 67 percent for eight hours, and 50 percent for five hours, a VFD will reduce energy use by 32 percent compared to an outlet damper.

Recently, a hospital in the Milwaukee metropolitan area retrofitted several air-handling units of its HVAC system with VFDs that replaced inlet guide vanes. A total of 330 hp of supply-air and return-air fans were updated with VFDs. The new systems, which operate 24 hours a day, are expected to save approximately \$36,800 each year (cutting annual costs from \$61,800 to about \$25,000) based on an energy cost of \$0.05 per kilowatt-hour (kWh). With the total cost of the retrofit at \$108,990, Focus on Energy estimates the project will pay for itself in less than three years.

VFD installation costs depend on the size and complexity of the project and in some cases may equal or exceed the cost of the drive itself. When retrofitting, check with the motor manufacturer to ensure the motor is rated for use with a VFD. Exact savings will vary depending on the load profile.

### FIND OUT HOW YOU CAN BENEFIT

How much energy and money could VFDs save your business, school, or government facility? Contact Focus on Energy to find out. Our professional energy advisors can help you learn more about the operational, economic, and environmental benefits of these practical energy savers. Call 800.762.7077 to learn more, or visit [focusonenergy.com/vfd](http://focusonenergy.com/vfd).