Variable Speed Drives

*Institutions can often **reduce their electricity use and costs by 5 to 15 percent or more** by improving the efficiency of their motor-driven systems, according to the US Department of Energy. The variable speed drives (VSDs) shown here are installed at the University of New Mexico.*

Businesses with large electric loads, large equipment and variable processes are prime candidates for the benefits of variable speed drives (VSDs). Water pumping stations, HVAC systems and manufacturers that use compressed air systems can save energy and money by installing VSDs on electric motors. Applications where energy load requirements vary are prime candidates. Examples include centrifugal pumps with variable torque loads and systems with fans and blowers.

Why improve energy efficiency?

1. Cuts your operating costs and improves profitability.
2. Reduces maintenance demands.
3. Distinguishes your business as being eco-friendly or "green."
4. Allows you to use energy savings to finance business growth.
5. Qualifies you for rebates from PNM.

Incentives Available for Installing VSDs

To help your company install energy-efficient VSDs, the PNM Business Energy Efficiency Program offers specific incentives for VSDs installed on HVAC fans and pumps, and custom incentives for VSDs installed on non-HVAC loads. Energy savings after VSD installation are often significant, so payback time can be short.

Variable Speed Drive Facts

Every day, millions of motors are hard at work operating everything from winding machines in aluminum mills to ventilation systems in office buildings. Motors drive the pumps that bring water to Santa Fe via the new Buckman Direct Diversion project and lift the elevators that take guests up to their rooms at hotels. In the manufacturing sector, half of all the electricity consumed is used to power electric motors. By some estimates, 90 percent of the motors in the world are not equipped with drives. Those statistics add up to energy-efficiency opportunities that you could be taking advantage of today.

According to the Department of Energy, motor-driven equipment accounts for 64 percent of the electricity consumed in the U.S. industrial sector.

For more information about the PNM Business Rebate Program, visit **pnmenergyefficiency.com** or **call the PNM Business Energy Efficiency Team at 505.938.9400.**

In many cases, motors operate continuously at the same speed. Therefore they are not as energy efficient. For example, airflow may be regulated, but the speed of the motor remains unchanged. VSDs, on the other hand, control the rotational speed of motor-driven equipment, adjusting the motor's speed to match actual demand. In situations where motors don't run when they aren't needed, energy consumption can be reduced by 20 to 50 percent.

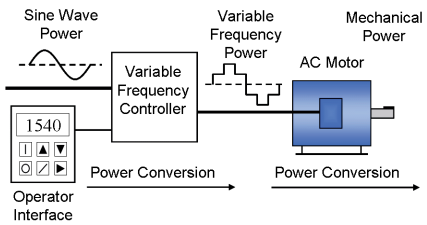
Even better, due to the mechanical features of fans and pumps and what are called the "Affinity Laws" (see **Doing the Math** below), small decreases in equipment rotating speed or fluid flow result in substantial reductions in power consumption. In fact, energy savings associated with the reduction in speed are cubed, which adds up to significant energy cost savings, especially when large horsepower motors are involved.

Pumping Systems

Most pumps operating today are oversized. Pumps are usually designed to meet maximum system demand; therefore, they rarely operate at full capacity. When throttling valves are used to control flow, the result is a loss of efficiency. However, energy-efficient VSDs can be installed in place of throttling valves.

VSDs provide efficient flow control by varying the pump's rotational speed. Even small decreases in speed or flow can significantly reduce energy use. For example, reducing the speed (flow) by 20 percent can reduce input power requirements by approximately 50 percent.

Variable frequency drives (VFDs) are the most common type of VSD in use today. Besides energy savings, VFDs offer "soft-starting" capabilities, which reduce thermal and mechanical stress on belts and other parts, decreasing maintenance costs. VFDs also reduce voltage fluctuations that can occur when starting large motors, improving system reliability.



A VFD works by converting a standard AC waveform to a DC waveform that can be controlled from the feedback it receives from the level of power needed by the process. The waveform is re-shaped several times per second.

How to Get Started

First, visit pnmenergyefficiency.com for more information about the PNM Business Rebate Program and call the PNM Business Energy Efficiency Team at (505) 938-9400. Then make a list of the motors in your company's operation to help identify candidates for VFD installation. Create a motor-use profile with the help of the U.S. Department of Energy's MotorMaster+ software tool, which is available at www.eere.energy.gov/industry/bestpractices. https://save-energy-now.org/EM/tools/Pages/HomeTools.aspx

Here are some basic guidelines:

- Consider VFDs for pumping applications that range from 1 to 1,000 horsepower, and remember the higher the horsepower, the more cost-effective the VFD installation.
- Centrifugal loads with variable-torque requirements, such as centrifugal pumps or fans, have the greatest potential for energy savings.
- Identify large motors that operate for long periods of time or those that are production-critical—they offer the best energy-savings opportunities.

VSDs are reliable; small changes reap large benefits; payback time can be short, and your project may qualify for incentives from the **PNM Business Rebate Program.**

Doing the Math

In hydraulics and air flow, the affinity laws express the relationship between the variables involved in fan and pump performance and power. The law is expressed as a ratio of the horsepower (hp) to the cube of the speed:

$Hp2 / Hp1 = (RPM2)^3 / (RPM1)^3$

So if the speed of a 10 Hp motor is reduced 20% the formula becomes:

$Hp2 = (8{,}000)^3 / (10{,}000)^3 \times 10Hp$
$Hp2 = 5.12\ Hp$

And the new horsepower needed to run the fan is nearly cut in half!

Small decreases in equipment rotating speed or fluid flow equal significant reductions in energy use. The affinity laws apply to pumps, fans and hydraulic turbines and are for both centrifugal and axial flows.

To find out if your business is a likely candidate for VSDs by consulting with an expert, please see the Trade Ally list at **pnmenergyefficiency.com.**

SOURCES

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