Saving energy with Variable Speed Drives

Worldwide, the industrial sector consumes about half of the total energy output, according to the International Energy Outlook 2011. Approximately two-thirds of this is consumed globally by motors - in the form of fans, pumps, compressors etc. – based on statistics by the International Energy Agency. Industries looking to increase their energy efficiency will do well by reducing the energy use of their motors.

A common strategy would be to incorporate variable speed drives (VSDs) into industrial applications. Successfully implemented, energy use at partial load can be reduced by up to 50% or more by matching motor speed to the changing load and system requirements. Engineering company ABB estimates about 115 million megawatt hours of electricity can be saved every year, reducing carbon dioxide emissions by 97 million tons.

Conventional motor systems operate at a constant speed, and changes in output are controlled by some form of mechanical throttling, such as valves or slats. Throughout the duration of operation, the motors continue running at full speed and use electrical energy at the full-load rate, even when performing less work. This is a terribly inefficient use of energy.

VSDs enable a more efficient way of controlling changes in output by changing the speed of the motors according to variations in the load, which occur most of the time when moving fluids.

What is a Variable Speed Drive?

A variable speed drive, also known as frequency converter, variable frequency drive, adjustable speed drive or inverter, is an electronic device that controls a motor’s electrical supply. Therefore, the speed and torque of a motor can be controlled to better match the process requirements. In processes where variable control is desirable, slowing down a motor with VSD reduces energy use significantly.

Application of Variable Speed Drives

Energy savings by applying VSDs differ according to load types of the motors. Here are some common types, and the energy savings that can be achieved by incorporating VSDs, charted here in figure 2.

![Figure 2: Energy savings from reduced speed, according to different types of load](image.png)

Figure 1: VSD incorporated to a motor
Variable torque:

Usually characteristic of centrifugal pumps and fans, this load type represents the biggest potential for energy savings. This is because the power required varies with the speed cubed; for example, a reduction of speed to 80% will result in reduction in power required to $0.8^3 = 0.512$, or 51%. This is a very significant saving, and with pumps and fans forming approximately a third of industrial motors, the application of VSDs will create a large increase in overall industrial energy efficiency.

Constant torque:

Characteristic of conveyors and air compressors, this load type also presents great potential for energy savings. The power required is directly proportional to the speed; for example, a reduction of speed to 50% will result in reduction in power required to 50%. Although the savings will not be as large as that of variable torque, application of VSDs will still achieve a significant increase to overall industrial energy efficiency.

Constant power:

Characteristic of machine tools and centre winders, loads of this type operate at a constant power. Thus, any reduction in speed will rarely produce any energy savings. VSDs will not find much application in this case.

**Benefits of Variable Speed Drives**

Besides increasing energy efficiency by better matching the process requirement and the motor speed, VSDs also improve efficiency through an increase in the power factor of the system. This means more of the current drawn is actually used to drive the process, making it more efficient.

Application of VSDs also improves process controls which lead to increase in output product quality. Reduced wear and tear of motors lead to greater longevity and require less maintenance. All these benefits lead to lower operating costs for industries and increase profitability.

Variable Speed Drives offer a multitude of benefits for industries, primarily the substantial cost savings through greatly improved energy efficiency. The application of VSDs will also go towards reforming the industrial sector into a cleaner and greener one.

To find out more about Variable Speed Drives, please see:

[http://www.abb.com/cawp/db0003db002698/a5bd0fc25708f141c12571f10040fd37.aspx](http://www.abb.com/cawp/db0003db002698/a5bd0fc25708f141c12571f10040fd37.aspx)


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