

# Variable Speed Drives:

Reducing energy costs  
in petrochemical  
manufacturing

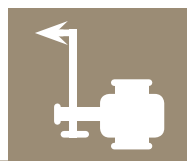
**Factsheet**



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## Variable Speed Drives reduce motor and pump costs in the oil, gas and petrochemical plants



**M**any applications in the oil, gas and petrochemical industries rely on motor driven pumps and pumping systems that are energy-intensive. Installing Variable Speed Drives (VSDs) on motor driven equipment can be an effective energy and operating cost saving measure for companies in the sector.

Although very few applications require a 100% flow continuously, many of the motors are started at full speed and continue running at full and fixed speed while in use and this wastes power.

Companies can save a vast amount of energy by modulating motor speeds. A 20% reduction in speed can help reduce energy usage by up to 50%. The higher the level of a motor's operating time, the larger the variation in load duty cycles, and the greater the savings.

### VSDs explained

A VSD also known as a Variable Frequency Drive or Adjustable Speed Drive, is a device that can adjust electricity supply and, regulates and adapts motor speed to match the actual demand required by the system or application it is driving, resulting in reduced energy consumption.

VSDs offer a high degree of motor control, accurately varying motor speed according to demand whilst adjusting torque accordingly - all within the specifications of a particular manufacturer.

VSDs come in many different sizes, and are typically encased in boxes that can be as small as a milk carton or as big as a cupboard. Sizes range from 0.18kW through to several MW. They are available as stand-alone devices connected to the electricity supply of the motor. On some smaller motor designs - usually under 15kW - VSDs may be built onto motors and are available as integrated motor drives.

A basic VSD can be used for simple applications - such as controlling a pump or fan - where variable loads are required. It can also be interfaced with a transducer, such as a pressure or flow rate sensor, and programmed to maintain a particular setting. More advanced VSDs can be used for precise speed and torque control in complex applications like materials forming and can be interfaced with a computing system to provide real time operating data on the status and performance of a motor.

**Motors, pumps and fans account for 27% of the electricity used in the industrial sector in South Africa. Optimising these systems with VSDs can dramatically reduce the demand for power while saving companies money on energy costs.**

### **VSDs in the gas, oil and petrochemical industries**

VSDs can be used in a wide range of applications in the petrochemical and pipeline industries to save energy and for process control optimisation. They can be installed to optimise equipment in all types of facilities, from production and distribution to refining and processing.

VSDs help to realise energy savings by controlling the characteristics of a motor's electrical supply, speed and torque to match its output closely with the process requirements of the machine it is driving. By gradually ramping up motor speed and controlling its output, VSDs ensure that the motor only runs at its maximum speed when necessary.

Aside from saving energy, VSDs can be used to gain tighter process control. Tighter control on variable processes means less energy usage. For example, a control valve may not be able to properly control a process variable due to a range of limitations, or pressure drop problems, resulting in wide process variations. The use of a VSD can provide tighter control, reduce overall waste and improve plant efficiency.

In the petrochemical and gas sectors, VSDs are also used to ensure timely, predictive maintenance and a reduction in downtime. Many VSDs have monitoring capabilities which deliver intelligence on motor performance. With the ability to monitor motor current and speed, VSDs can perform protective functions based on this information. With access to more detailed information over longer periods of time, engineers can better use predictive trending to anticipate problems and prevent chronic failures.

In extreme situations, the VSDs can act as a protection to the motor. Most drives have a built-in electronic motor thermal overload feature. When a motor is in a state of severe exertion, beyond its safe operating limits, the motor overload feature can help reduce the output current or shut off the motor and protect it from thermal damage or catastrophic failure.

Equally important is the far-reaching impact that VSDs can have on the overall health of automated systems. In fact, converting a process from fixed speed to variable speed can minimise wear and tear and reduce maintenance requirements for mechanical systems by reducing start/stop cycles

and eliminating valves and other mechanical components. In addition, it can also maximise the efficiency of the motor and extend the life of many rotating parts in a typical motor pump combination.

<http://www.pumpsandsystems.com/topics/instrumentationcontrols/variable-frequency-drives-oil-and-gas-pumping-systems>

## Slowing down a pump or fan from 100 to 80% can reduce a motor's energy usage by up to 50%.

Any machine or process that can be improved by varying speed or flow is a candidate for a VSD. Applications that can be optimised with VSDs in the oil, gas and petrochemicals industry include:

- Gas lift compressors and injection pumps
- Pipeline pumps
- Loading pumps
- Pipeline compressors
- Reciprocating compressors
- Pumps for water disposal
- Chemical processes
- Refrigeration processes
- Hydrogen recycling processes
- Distribution pumps
- Refineries

**It is important to note that VSDs cannot be utilised on all types of compressors. The majority of the hermetic type compressors cannot be used with a VSD because of the oil feed system, which is not designed to work at a low speed.**

### Beyond improved energy efficiency

VSDs have numerous benefits that go beyond energy efficiency, they:

- Enable precise control over applications such as conveyors or winders and can also help to control pressure, flow and temperature
- Allow soft starting, which can reduce stress on motors and bearings and, therefore, extend equipment life



- When linked to a remote control, it can be used to switch off motors or to lower the speed of motors to decrease the air or water flow rate during Eskom's peak hours of demand for electricity
- Help to improve power factor (some makes of VSD)
- Allow for the rapid adjustment of speed, torque and power to provide better control in high speed applications
- Deliver meaningful intelligence on the status and performance of motors when interfaced with computers or wider process control systems
- Avoid penalties for exceeding the supplied kVA
- Can run more than one motor at a time **under certain conditions** - in fact, up to six fans can be controlled by one VSD
- Can reduce noise levels.

A smart VSD with a built-in Programmable Logic Controller (PLC) can do sequence starting and sequence stopping and, therefore, replaces a number of devices. It also enables more frequent starting and can help to reduce motor heating.

**Fans and pumps are usually the best applications for VSDs because these applications have variable torque loads whose outputs are regulated in some way.**

### Things to consider before implementing VSDs

- Conduct a proper feasibility study before investing in VSDs to ensure that they are the most appropriate solution for optimising your process.
- Consider the age of your equipment - the working condition of existing motors, pumps and fans can influence potential energy savings, particularly in older technologies.
- VSDs can increase harmonics in the electricity supply, which disturb the sine curve of the Alternating Current and cause motors to run warmer than they were designed for, reducing their life expectancy. Harmonics can also decrease the life expectancy of computers and negatively influence the operation and accuracy of electronic measuring devices. The appropriate harmonic filters and chokes must therefore be installed along with the VSD to filter out the harmonics and protect your equipment.
- Full energy-saving gains will be achieved when harmonic filter protection and components are properly installed and tested.
- Since VSDs are dust sensitive, an appropriate dust filter needs to be installed when operating in dusty conditions - they also need to operate within specified temperature and humidity parameters.

- VSDs must be installed by qualified installers who can backup their product.
- Once installed, VSDs must be correctly programmed - setting incorrect parameters will result in poor control and energy wastage.
- Regular maintenance on VSDs - and associated motors - is essential to maintain energy savings; preventive maintenance is always less expensive than correcting faults and having unanticipated breakdowns.
- Opt for a maintenance contract with your supplier to ensure VSDs are kept in optimal condition.

Important note: If you have a power factor correction capacitor installed, remove it before installing a VSD.

**Reducing energy usage makes perfect business sense; it saves money, enhances corporate reputation and helps in the fight against climate change.**

**Eskom's Energy Advisors are on standby to assist you.**

**Eskom's national Advisory Service offers information on manufacturers and suppliers of VSDs. The team can also advise businesses on:**

- Reducing energy usage
- Doing walk-through energy assessments to identify energy usage patterns, energy needs, areas of energy wastage and energy-saving opportunities
- Improving the energy efficiency of operations and electrical systems and processes
- Prioritising maintenance as an important contributor to reducing energy usage
- Finding SANAS approved energy savings Measurement & Verification Authorities.

Advisors can also provide information on funding opportunities for energy efficiency projects.

Call 08600 37566, leave your name and number and an Eskom Energy Advisor will contact you, alternatively, ask for a specific advisor to contact you.

Visit [www.eskom.co.za/idm](http://www.eskom.co.za/idm) for more information.

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