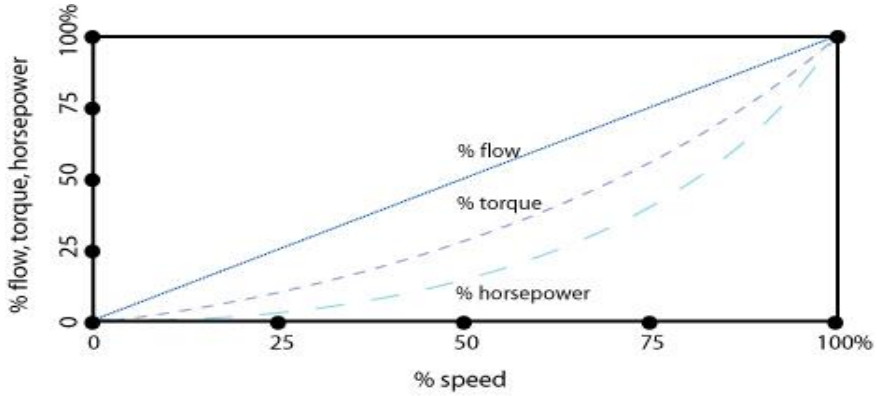
ENERGY SAVINGS WITH VARIABLE FREQUENCY DRIVES AND INVERTER DUTY MOTORS

The typical HVAC system is designed with a peak load condition in mind. However, since it is not uncommon for these systems to be running at a reduced load throughout most of the year, flow control mechanisms such as dampers, valves and inlet guide vanes are often used. While these methods are able to control the output flow of the system, they waste a lot of energy; the system is still running at the same capacity while the output flow is managed and diverted.

Controlling the output of the HVAC system itself can directly lead to significant energy savings. It is evident from the **Affinity Laws** which state relationships between HP, Flow, and Torque i.e.

- **Flow is proportional to speed**
- **Pressure (Torque) is proportional to speed squared**
- **Power (HP/kW) is proportional to speed cubed**



As a result of these relationships, we can see that a small reduction in the required airflow implies a large reduction in horsepower. In fact, running 2 motors at half speed requires less energy than running 1 motor at full speed.

APPLICATIONS FOR THE VARIABLE FREQUENCY DRIVES IN THE HVAC INDUSTRY

CENTRIFUGAL FAN: Centrifugal fans are often used to produce the air flow in HVAC systems, and two common methods of controlling this flow are discharge dampers and inlet guide vanes. While both of these are excellent ways of controlling the output of the HVAC system, they have a much higher energy requirement than an equivalent solution involving variable frequency drives. From the above diagram outlining the required horsepower as a function of the required air flow, you can see, the variable speed drive solution offers the greatest energy savings.

CENTRIFUGAL PUMP: The most common method of controlling the flow from a centrifugal pump is through the use of a throttling valve. From the above diagram outlining the required horsepower as a function of the required air flow, you can see, the variable speed drive solution offers the greatest energy savings.

COOLING TOWER: Cooling towers are used to lower the temperature of water for use in HVAC systems. This is done by blowing air across condenser water in order to transfer the heat out of the water and into the air. However, to achieve the correct amount of cooling, the centrifugal fan (which is used to blow the air) is cycled on and off according to the demand. This results in a poor use of energy, and a large increase on the mechanical stress experienced by the motor. By using a variable frequency drive, the centrifugal fan is able to run at a rate appropriate for the given demand. This results in a significant energy savings, as we discovered above.

GERRIE

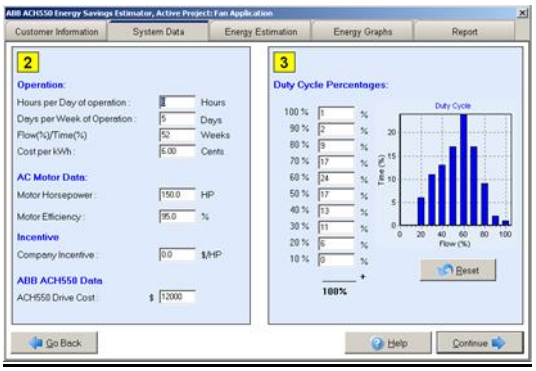
ENERGY SAVING WITH VARIABLE FREQUENCY DRIVES

FACT

ABB's installed base of variable-speed drives have now save customers enough energy to serve a country of five million people, eliminating nearly 100 million tons of carbon dioxide emissions every year.

More than 65% of electrical energy consumed in industry is by the electric motor. Governments worldwide are realizing the need to encourage more effective use of motors with electrical variable speed drives.

It is evident from the Affinity Laws which state relationships between HP, Flow, and Torque; that 20% reduction in flow can result in approximately 50% reduction in horsepower for centrifugal loads like blower, fan, and pump.



ENERGY SAVING ESTIMATING TOOLS

ABB has developed software tools such as Energy Savings Estimator, PumpSave and FanSave for accessing the saving potential in different motor applications. PumpSave and FanSave have been essentials in the plant or design engineer's toolbox for more than a decade.

PumpSave is a calculation tool used to estimate the energy savings available when using a variable speed AC drive compared to other pump control systems. Comparisons are made with throttling control, ON/OFF control and adjustable speed control using a hydraulic or other type of slipping drive.

FanSave is a calculation tool used to estimate the energy savings available when using a variable speed AC drive compared to other fan control systems. Comparisons can be made with damper control, pitch control, single speed vane control and 2-speed vane control.

ENERGY APPRAISAL SCHEME

ABB has devised an Energy Appraisal Scheme that can rapidly determine just where and how much energy can be saved.

REPLACEMENT DRIVE SCHEME

If you have had drives installed for more than five years, you could save even more energy by replacing them with the latest technology drives. ABB's Replacement Drive Scheme offers you a turnkey solution for replacing drives, giving minimum plant disruption.

AC drives reduce energy wastage by changing the motor speed. This saves energy because the motor does not use more electrical energy than required.