

Slightly Slower Equals Big Savings

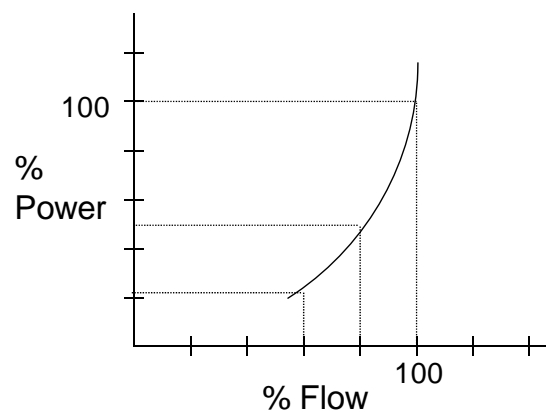
Why VFDs generate dramatic savings

Centrifugal loads, such as those on pumps and fans, offer the greatest potential for energy savings for Car Washers. However, they will only generate savings when operating at less than 100% of flow or pressure to match demand. The key is to understand the application and find points during operation to slow the motor down.

The Affinity Laws govern the flow of fluids such as air and water. The Affinity Laws state the following:

- Flow is directly proportional to speed
- Torque required is proportional to speed squared
- Horsepower required is proportional to speed cubed

For example, the Affinity Laws are shown graphically to the right where the curve is the fan or pump. This clearly shows that reducing the fan or pump speed, even slightly, results in a large reduction in required horsepower. This adds up to significant energy savings. At 60% flow, the horsepower required is only 21.6%.



Using our example again, take a 100-hp induction motor with a 95% efficiency rating running at 100% speed and 100% load will cost \$27,139 per year to run, according to the following formula:

$$(100 \text{ hp}) \times (1/95\% \text{ eff.}) \times (.746 \text{ kw/hp}) \times (.08 \text{ \$/kWh}) \times (12 \text{ h/day}) \times (360 \text{ day/year}) = \$27,139$$

However, the same 100-hp induction motor running at 60% speed and 22% hp will cost \$5,970 per year to run, according to the same parameters:

$$(100 \text{ hp}) \times (0.22) \times (1/95\% \text{ eff.}) \times (.746 \text{ kw/hp}) \times (.08 \text{ \$/kWh}) \times (12 \text{ h/day}) \times (360 \text{ day/year}) = \$5,970$$

Consequently, the resulting savings of \$21,169 per year occur because affinity laws for motors reduce the horsepower required to run a motor by the cube of its speed. In this case, $0.60 \times 0.60 \times 0.60 = 0.216$.

Variable Frequency Drives save energy as shown above by reducing the actual speed of the fan or pump when full flow is not required. Otherwise, the motor always runs at full speed.