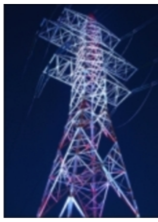
Michaels engineering

www.MichaelsEngineering.com



Michaels Engineering Energy Brief

HIGHER STATIC HEAD, LOWER VFD SAVINGS

SUGGESTIONS...

Do you have certain Energy Efficiency topics you'd like to know more about? Send an email with your suggestion to the author listed below and your topic might become a future Energy Brief!

DID YOU KNOW...

...When a system has high static head requirements, the range of power consumption that the VFD can modulate over is reduced, which in turn reduces the potential energy savings.

...More often than not, the savings for high static head VFDs are not calculated correctly.

MEET THE AUTHOR

Mike Frischmann is an Energy Engineer at Michaels Engineering. For more information on this topic or additional energy concerns, please contact Mike at:

(608) 785-1900 or
MTF@MichaelsEngineering.com

VFDs SAVE TONS OF ENERGY...SOMETIMES.

Wondering why that variable frequency drive (VFD) isn't producing the energy savings you were expecting? In a previous Energy Brief "When VFDs Don't Save" we discussed various reasons as to why VFDs may not save as much energy as anticipated.

One possible explanation is that the system the VFD is installed on has high static head requirements. High static head is simply the pressure at the pump outlet when flow is reduced to zero. For example, when pumping up to a water tower, it is equal to the height of the water column, which is approximately 60 psi or about double the pressure in your car tires. Water will not flow up the tower until the pump develops at least 60 psi. There is also static head in most pumping systems so the equipment served by the system is assured to get enough flow when required.

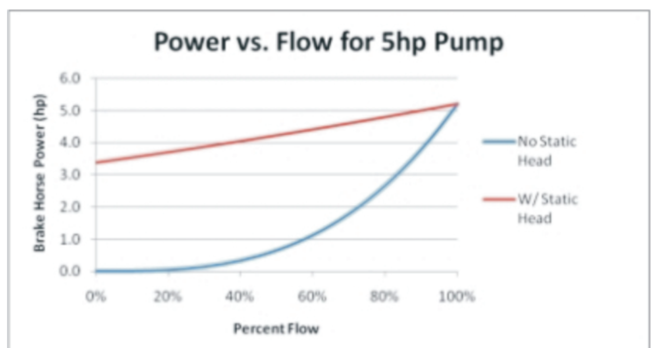
HOW DOES HIGH STATIC HEAD AFFECT ENERGY SAVINGS?

The brake horsepower for a pump is calculated based on both the flow rate and the system pressure. When a system has high static head requirements, the range of power consumption that the VFD can modulate over is reduced, which in turn reduces the potential energy savings.

The control scheme of these types of systems also impacts the potential energy savings. Often times we've seen instances where systems with high static head are simply cycled on or off, or are equipped with dual speed pumps. While VFDs are an improvement for these types of control methods, they will not generate large amounts of energy savings that are commonly predicted.

CALCULATE SAVINGS THE RIGHT WAY

Adding to the problem is the fact that more often than not, the savings for high static head VFDs are not calculated correctly. During our field and calculation verifications, we often see the savings calculated using the well known Affinity Laws. The Affinity Laws relate speed ratios to flow ratios, head ratios, and power ratios. Below is the Affinity Laws relating speed and flow, as well as speed and power.



Speed1/Speed2 = Flow1/Flow2
(Speed1/Speed2)3 = Power1/Power2

What we don't often see, is using the Affinity Laws with static head taken into consideration. This has a significant impact on the predicted energy savings. Let's take a look at a simple example system that utilizes a 5 hp pump, operating continuously throughout the year at 60% flow. If we ignore the static head, applying the above Affinity laws, requiring 60% flow would allow the VFD to modulate to 60% speed, reducing the power required from 5.0 hp to 1.1 hp. That's 78% energy savings! However, let's say that this system has a minimum static head requirement of 30 ft, and the design static head is 40 ft. Including the required speed to overcome this static pressure increases the calculated pump power to 4.4 hp, and decreases the energy savings to 15%. While 15% is still substantial, it's nowhere near the original 78% that was estimated.

When calculating VFD energy savings, it is important to include the static head requirements of the system. That way, you'll make sure you have more accurate savings estimates, and avoid any unnecessary "head" aches.

Offices in La Crosse, Milwaukee, St. Paul, Green Bay