

# Variable Frequency Drives (VFDs) with Simsite® Engineered Technology

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The use of Variable Frequency Drives (VFDs) are becoming more and more popular today in an effort to maximize efficiency. VFDs are designed to replace the constant adjustment of the pumping systems, either by throttling of discharge valves or recirculating.

Variable Frequency Drives have been publicized as the instrument of choice to reduce electrical consumption for all pumps by reducing the RPMs of the motor when a lower demand in the system is required. In most fields, the majority of VFD systems operate by monitoring the discharge pressure of the pump. When the demand increases, the VFD increases the motor speed and when the demand decreases the VFD reduces the motor speed.

However, when the pump is running slowly using a VFD system, the pump can be operating so far away from its design operating curve that a significant percentage of the efficiency gained by reducing the speed of the motor is cancelled out due to the mechanical losses of efficiency of the pump. The only way to resolve this is to either change the pump to match the operating range required, which can be expensive, or, as a more cost effective measure, fit a Simsite® re-engineered impeller to match the desired operating range of the pumping system.

Due to the advanced technology used in the design and machining of SIMSITE® structural composite impellers and wear rings, a far higher efficiency can be achieved; and therefore, a substantial reduction in energy costs can be achieved compared to traditional 'cast' parts. Longer term benefits of preventing energy loss, corrosion, erosion, and cavitation of the rotating element as a result of the implementation of

VFDs with re-engineered Simsite® impellers and wear rings reduce ongoing maintenance and replacement costs.

A scrubber system recently installed on one of the major cruise vessels, incorporated 5 main scrubber feed pumps designed for 800 m<sup>3</sup>/H at an 80 M head at 1750 RPM with 250 kW motors. All were fitted with VFD's located in a separate air-conditioned room. A review of the system showed that these pumps operate at 96% continuous load when the scrubber system is operating.

When you look at the efficiency curve for the 300 HP (250 kW) VFD Drive, operating at 96% load, the efficiency of the VFD is approximately 97%. When you multiply the VFD Efficiency of 97% by the total efficiency of the pump of 76% operating with a 96% system load requirement; you end up with a total pump & VFD efficiency of 74%. So the pump is operating at a capacity of 768 M<sup>3</sup>/H (3379 GPM) @ 73 M (241 Ft) head @ 1680 RPM.

Using the BHP Formula:

$$\text{BHP} = \frac{(\text{Cap in GPM}) * (\text{Head in FT}) * (\text{SG of sea water})}{(3960) * (\text{Pump Eff})}$$

$$\text{BHP} = (3379) * (241) * (1.02) / (3960) * (.74) = 285 \text{ HP}$$

With a BHP of 285 HP, the pump will have an Efficiency savings of 19 HP (300 – 285) = 15 HP or **11 kW**

$$\text{Energy Savings} = (11 \text{ kW}) * (.11/\text{kW}) * (8600 \text{ hours}) = \underline{\$10,510 \text{ per year.}}$$

Compare this result with the overall Pump & VFD efficiency if a re-engineered machined Simsite® Impeller was used for this scrubber system with an operating point of 768 m<sup>3</sup>/H (3379 GPM) @ 73 M (241 Ft.) @ 1680 RPM, then the pump efficiency would be **85%** instead of 76%, and the total pump and VFD efficiency would be (.85) \* (.96) = **82.5%** instead of 74% total efficiency!

Substituting in the new total pump & VFD efficiency of 82.5% into the BHP Formula we get the following:

$$\text{BHP} = (3379) * (241) * (1.02) / (3960) * (.825)$$

BHP = 255 HP or an Efficiency savings of 45 HP (300-255) or **34 kW**

Energy Savings with Simsite® Impeller & Rings = (34 kW) \* (.11/kW) \* (8600 hours)  
 = **\$31,784 per year** or an **additional savings of \$21,274 per year!**

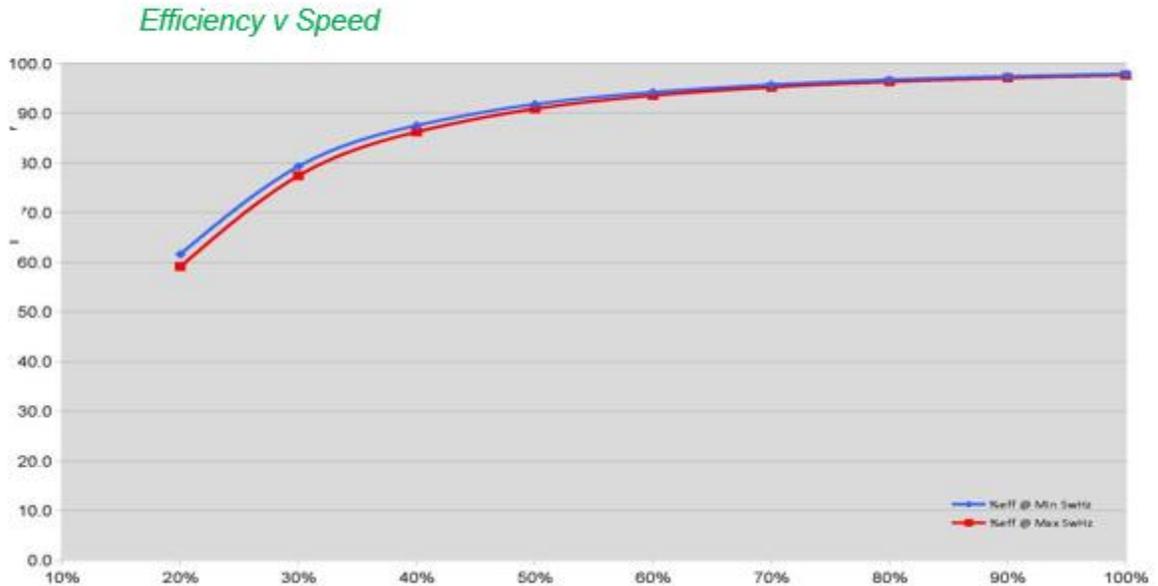
Examining the performance of the five cyclone feed pumps which pump from the drain tank to the cyclone separators, we see that these pumps are the same size and performance; however, they operate at a range of 50% to 90% for most of the time.

The VFD chart shows that the VFD efficiency at 50% of demand is only 89% efficient and the VFD efficiency at 90% of demand is 96% efficient. Looking at the chart below helps us to understand the true energy savings and the huge savings potential when you combine a VFD drive with Simsite® technology employing an engineered Impeller and Ring set.

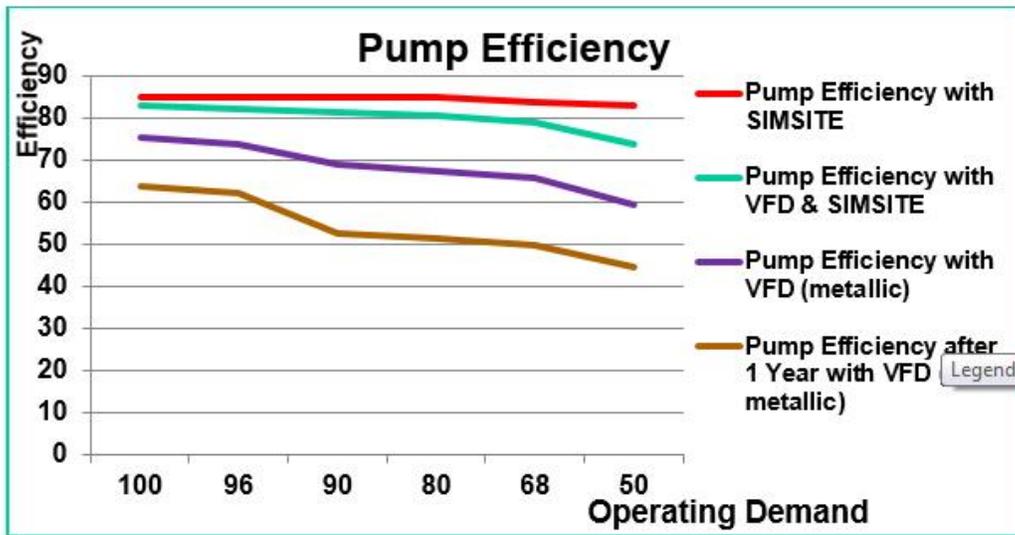
Energy Savings — VFD with Simsite® Impellers & Rings:

Operating Demand	VFD Eff	Efficiency Simsite®	Total Eff w/ Simsite® & VFD	BHP w/ Simsite® & VFD	kW Sav	Cap	Head	Rpm	Savings/yr with Simsite® & VFD
100	98	85	83.3	285.2	11.0	3520	262	1750	\$10,452
96	97	85	82.5	254.9	33.6	3379	241	1680	\$31,784
90	96	85	81.6	212.2	65.4	3168	212	1575	\$61,865
80	95	85	80.8	150.6	111.3	2816	168	1400	\$105,280
68	94	84	79.0	94.6	153.0	2394	121	1190	\$144,763
50	89	83	73.9	40.2	193.6	1760	66	875	\$183,102

Voltage rating: 460V. HP Rating: 300hp. Drive type: 6 pulse

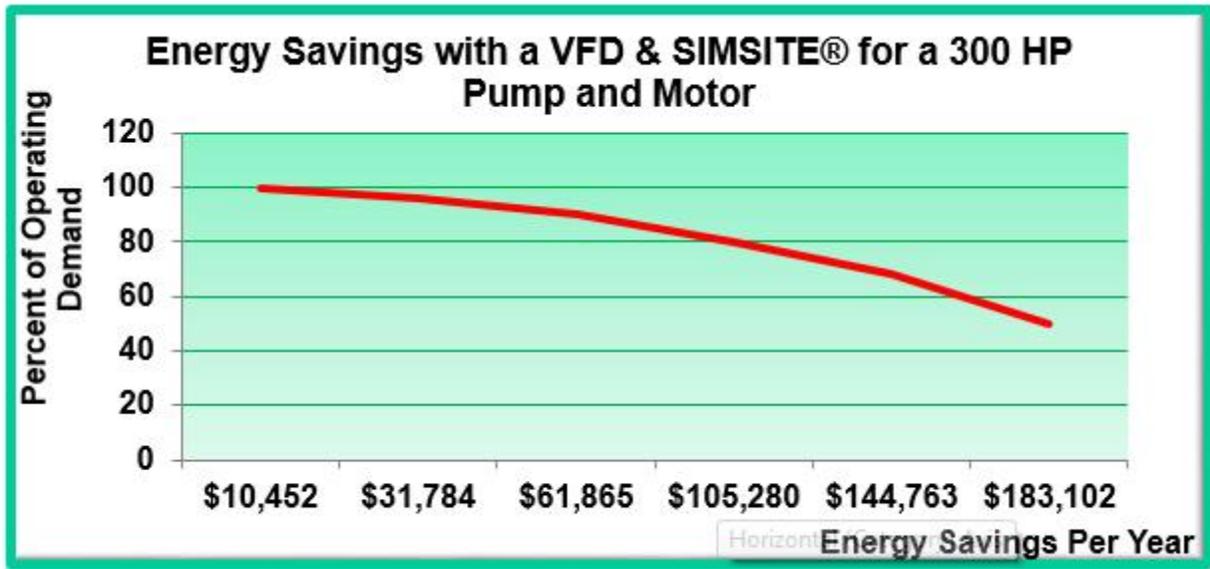


Only by installing Simsite® engineered pumps and/or Simsite® impellers & rings can a valuable investment in a VFD pumping system be maximized with minimal losses compared to a traditional VFD and pump setup. Furthermore, the corrosion, erosion and cavitation of the metallic pumps and impellers will force the VFD drive to increase the motor speed which eliminates the cost saving energy benefits of the VFD system if Simsite® engineered pumps or impellers are not used.



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The chart below shows the Money Saved in just one year with a VFD + Simsite® system.



### About Sims Pump

SIMS manufactures SIMSITE® Engineered Structural Graphite Composite Pumps and Pump parts, (Impellers, Casing Rings, Sleeves, Bushings, Mechanical Seals, Backplates, Shafts, Complete Volute Pump Casings, etc.) which are LIGHT WEIGHT and NEVER CORRODE IN SALT WATER, WASTE WATER, RIVER WATER or CHLORINATED WATER!

Simsite® is a patented structural graphite composite material ...offered exclusively by the Sims Pump Valve Company, Inc. Because of Simsite®'s excellent mechanical properties, it is one of the strongest composites on the market today. As a heavy-duty structural composite, Simsite®'s characteristics can be engineered to accommodate the specific requirements for strength and design of the parts and pumps being manufactured.

SIMS manufactures Simsite® structural Composite Pumps, Pump Parts, and many other structural components, which are light weight, energy efficient, and stand up much better to corrosive environments. All Simsite® products are resistant to erosion

and cavitation. Simsite® Pumps and Pump parts NEVER corrode in Salt Water, Waste Water, River Water, or Chlorinated water.

Simsite® Products outlast and outperform other products on the market, and will therefore significantly improve performance and reliability. Beyond performance, a look at total costs reveals that Simsite® composites are an exceptional added value. An evaluation of maintenance, spare parts, inventory, and energy usage, shows Simsite® composites to be the best option for centrifugal pump applications.

Simsite® is a patented family of superior structural engineered Composite Pumps and Pump Parts approved by the US Navy, for Navy, Marine, Chemical, Industrial and Waste water applications.

#### Key Benefits of Using SIMSITE® Pumps and Pump Parts:

- Corrosion resistant and chemical resistant.
- NEVER Corrodes in salt water, waste water, river water, or chlorinated water!
- Cavitation & Erosion Resistant.
- Superior to all metallic Pumps in Salt Water, Waste Water and Chlorinated Water services.
- Higher Efficiency.
- Light Weight. 1/6 the weight of bronze or stainless steel.
- Simsite® Impellers have Perfect Balance & they Maintain this perfect balance over the life of the pump
- NO electrolysis.
- Increased performance, longevity and reliability!
- Simsite® Pump Casings are 100% machined on the inside as well as the outside from solid blocks of the structural composite which offers Superior Mechanical Strength, Perfect Balance, Better Performance, and Longer Life. Simsite® Impellers, Open or Enclosed, are Precision machined from one piece.
- Simsite® Backplates fit all mechanical seals, or packing. The Seal chambers can be enlarged for better seal life & performance.
- Simsite® Mechanical Seals offer superior sealing with silicon carbide against silicon carbide faces.