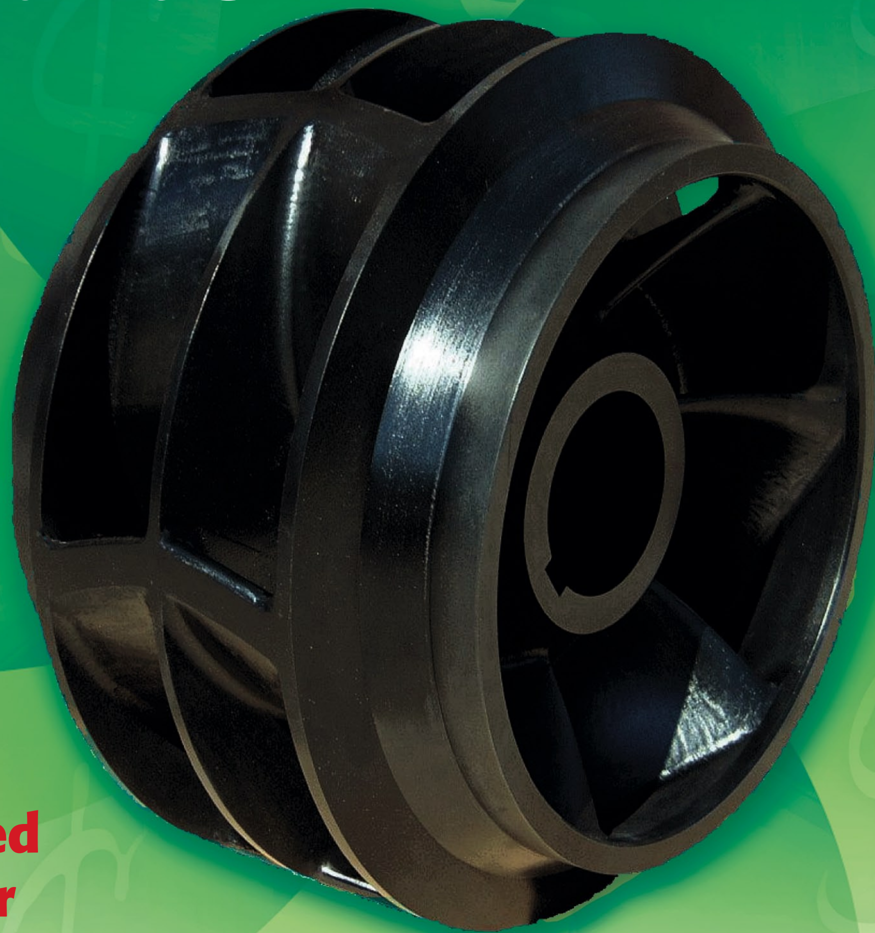
Save Thousands of Dollars Per Year!



Simsite® Re-Engineered Double Suction Impeller

Re-Engineer Your Impellers!

Sims Custom engineers pumps to meet your specific requirements.

Sims Pump Company

Since 1919

***Simsite®**, Structural Composite Pumps, Impellers, Rings and Parts*

It is an all too common problem – You purchased a pump for one specific performance and when you put the pump in service in your plant or ship, the pump ends up operating at another point completely different from the original design point (best efficiency point – BEP) of the pump. In addition to being very inefficient, when you operate the pump away from the original design point or best efficiency point (BEP) it causes a multitude of problems. These problems include excessive noise & vibration, shaft oscillation, cavitation, premature wear and failure of mechanical seals, bearings, rings, sleeves and impellers. In extreme cases, the shaft will break right behind the impeller from the excessive radial forces that occur when you operate a pump away from the original design point. Damage to these pump internals and poor reliability are a real and direct result of such operation.

Fortunately, these problems can be easily resolved by re-engineering the impellers. Companies like **SIMS PUMP Company** in Hoboken, N.J. can redesign these impellers to operate at the new system design point. Now, the best efficiency point (BEP) will be the true operating point in the plant or ship system. Not only is the efficiency of the pump improved, but also the reliability of the complete pump is substantially improved.

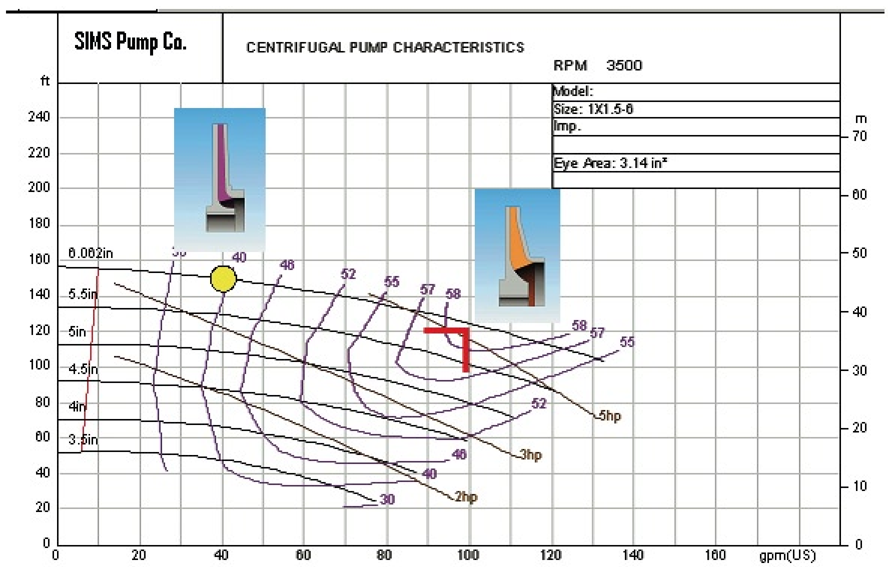
The effect of operating a pump away from the best efficiency point (BEP) has a detrimental effect on pump efficiency and wastes energy and money. The larger the pump, the more energy is wasted when a pump operates off the original design point; however, operating any pump away from the BEP wastes a tremendous amount of money since 85% of the total cost of owning a pump is the Operational Cost (Maintenance cost plus the cost of energy).

BEP: B=Best E=Efficiency P=point

Lets take a look at the pump curve for a 1 x 1.5 – 6 pump:

Let's consider a relatively small pump first. For example, if a customer is looking for a pump to produce 40 GPM at 140 feet of head, a 1x1.5- 6 pump size (with approximately 6" impeller diameter) may be selected from hydraulic curves. The pump will work, but unfortunately will not be operating at its optimum design point or best efficiency point.

As is evident from the hydraulic curve for this pump size, this pump will have 40% efficiency (yellow circle). However, the optimum design point or best efficiency point (red angle) is at 58% efficiency. The result is that the pump operates to the left of its BEP point for the impeller diameter required to achieve the desired head.



As we have previously stated, issues of radial thrust, vibrations, and premature wear will definitely result. But, let us see what effect this will have on energy consumption.

In the above hydraulic curve example, note that the horsepower line that passes near the operating point is approximately at 4 hp, which is roughly 3 kW. How much does it cost to operate this pump if running continuously, 365 days per year, at, say $0.10 per kilowatt-hour?

3 x 24 x 360 x 0.10 = $2,592

Now, what would it cost if the efficiency were somehow improved to the 48% efficiency that this pump would enjoy if the system operating point were to become the best efficiency or design point by redesigning the impeller? Obviously, if a pump runs more efficiently, it will take less power. In fact, the power (and thus cost) would be inversely proportional to efficiency:

$2,592 x (40/48) = $2,160

The net ELECTRICAL savings would thus be

$2,592 – $2,160 = $432 per year, which is 17% less!

However, when the pump is operating at 40GPM at 155 FT, instead of 100 GPM at 120 FT, the pump is operating in the danger zone, 60% away from BEP (Best efficiency Point). At this point, the pump is subject to high radial loading, which causes tremendous noise & vibration and excessive shaft oscillation. This leads to premature bearing, mechanical seal, and impeller failure.

Old Technology - Metallic

New Technology - SIMSITE®

The new Re-engineered Simsite® Performance Curve will be as follows:

Using the chart in (figure 2), you can see that when the pump operates 60% away from design point (40 GPM at 155 FT. like in the example in the pump curve above) the pump failure rate has increase drastically, by 5.2 times!

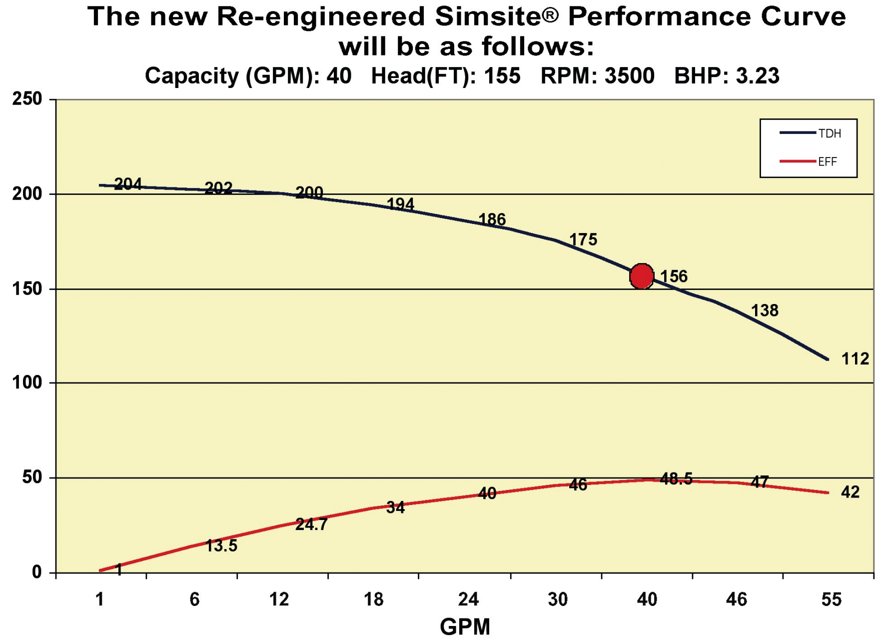
833 days/163 days = 5.2 Times or 520% Higher Cost

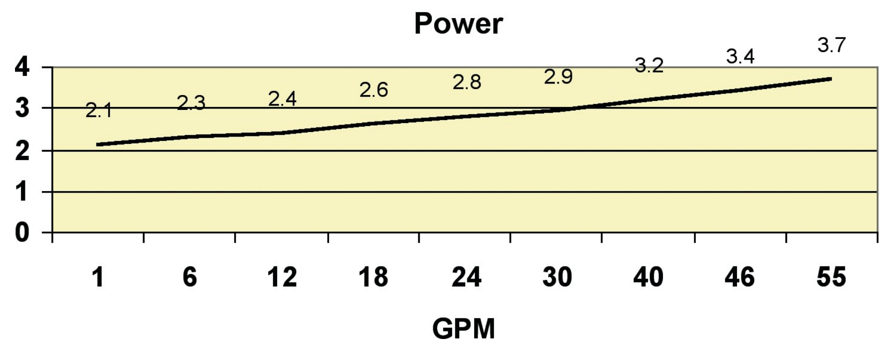
In other words, on the average, this pump will have to be overhauled 5 times more than if it operated at BEP. With an estimated overhaul price of $2500, the operational cost is approximately $13,000 more than it should be!

Redesigning the Impeller and installing a new SIMSITE, re-engineered impeller will save Electrical Costs and more importantly Operational Costs.

Electrical Cost
= $432 Savings per year per pump.

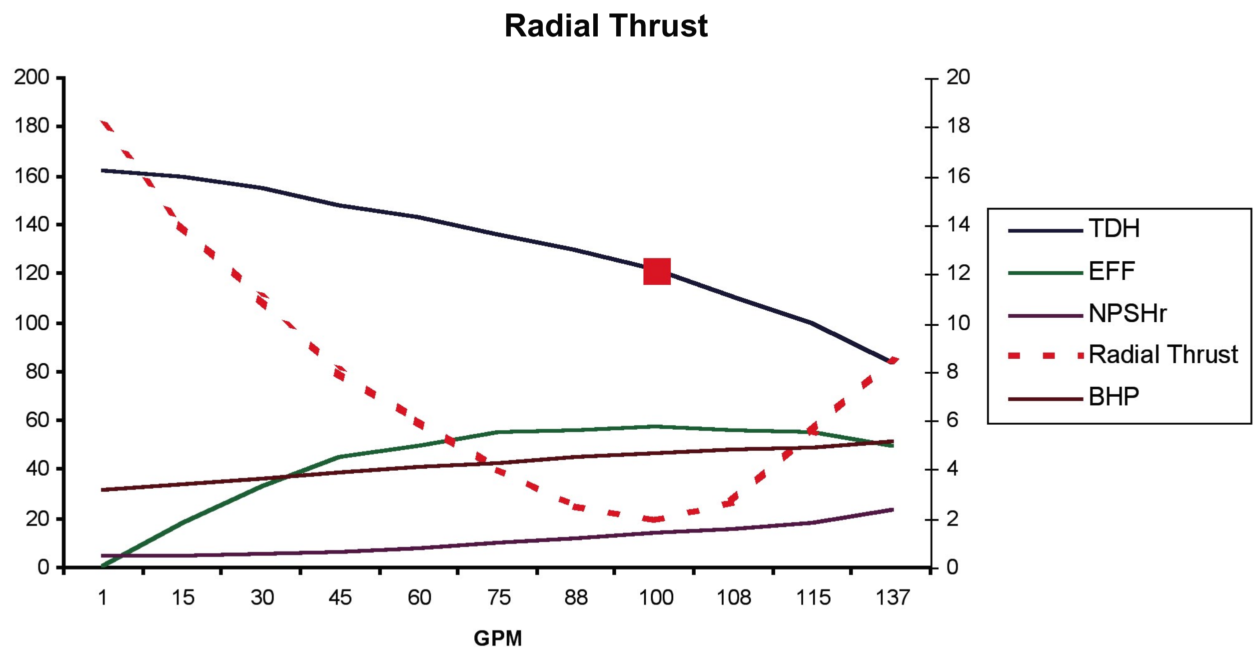
Operational Cost
= $13,000 Savings per pump





Sims

Custom engineers pumps to meet your specific requirements.



When a centrifugal pump operates to the left of the originally designed BEP (Best Efficiency Point) or to the right of the BEP, many bad things happen. First, radial thrust grows exponentially, resulting in significant shaft deflections and oscillations, which leads to premature mechanical seal failures, bearing failures, excessive bushing, ring, and sleeve wear and even shaft failure (breakage). Also, a hydraulic phenomenon called "rotating stall" sets-in, which is essentially a back-flow, leaving the impeller eye, and progresses backwards, which can result in violent piping vibrations, pressure pulsations, and premature wear of the components. The problem intensifies when a hydraulic parameter called "suction specific speed" (NSS) is high. Suction specific speed is the geometric relationship between the impeller eye diameter and the impeller outside diameter, and the NPSHR. It is an indirect indication of the impeller eye being too large, but also depends on several other factors, related to design, installation and application. There are certain engineering rules and principles related to minimum allowable flow - as function of pump energy, specific speed (NS), suction specific speed (NSS), and other factors, which – when violated – can cause trouble and problems.

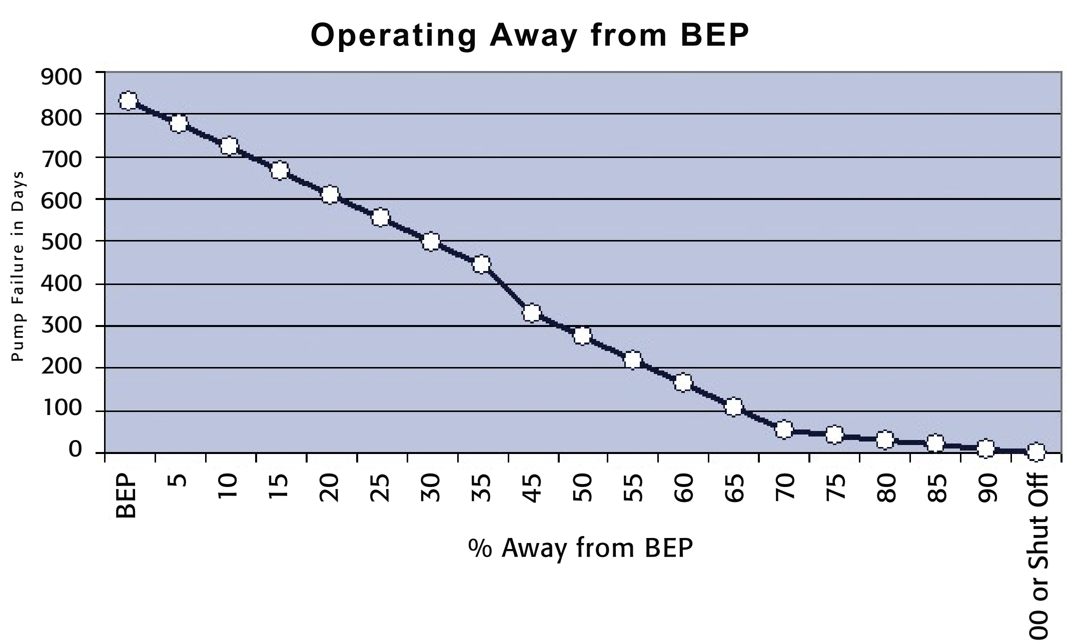
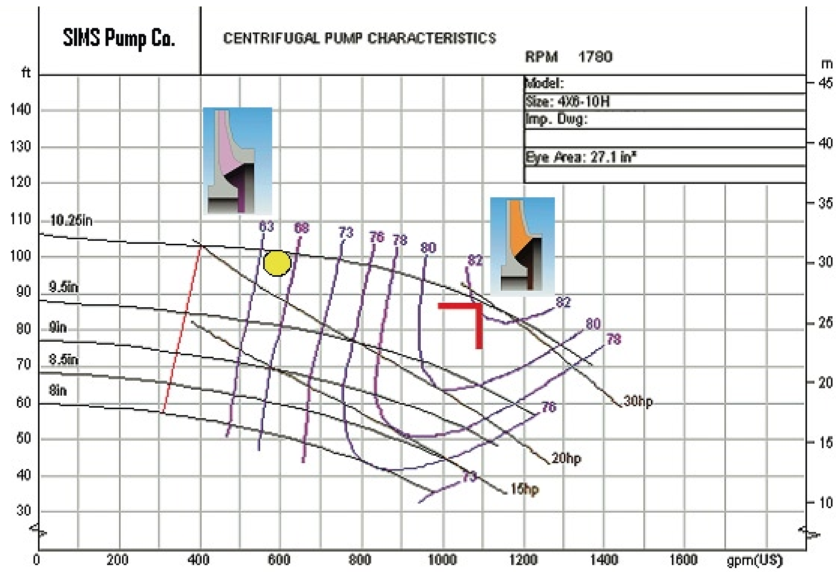


Figure 2

Operating Away from Design Point – The above chart represents an average failure mode based on information compiled by Sims Pump Company.

Next, let's consider a somewhat larger pump. Say we have a 4x6-10 size that is operating in the plant system at 600 gpm and producing 100 feet of head:

Again, the pump is off the efficiency peak. It operates at approximately 65%, whereas its peak efficiency at that diameter (10.25") should be 82% at the original specified performance of 1100 GPM at 88 Feet! Now, the energy dollars become more pronounced. Its power consumption is approximately 25 hp (19 KW), according to horsepower lines in the proximity of the operating point:



19 x 24 x 360 x 0.10 = $16,416

The electrical cost to operate the pump would be substantially less if efficiency were increased by re-designing the impeller to operate at the system requirements of 600 GPM at 100 Feet instead of 1100 GPM at 88 Feet. The efficiency at this new point would be increased to 78%:

$16,416 x (65/78) = $13,680

The electrical savings would be: $16,416 – $13,680 = $2,736 per year, about 16% in this case!

This pump is operating in the system at 600 GPM at 100 feet instead of 1100 GPM at 88 Feet which is approximately 45% away from the original design point:

(600/ 1100 = 55% -100 = 45% away from design point)

From the chart above, we can determine that when this pump operates 45% away from the original design point (1100 GPM at 88 Ft. like in the example above) the pump failure rate has increased drastically, by 2.56 times!

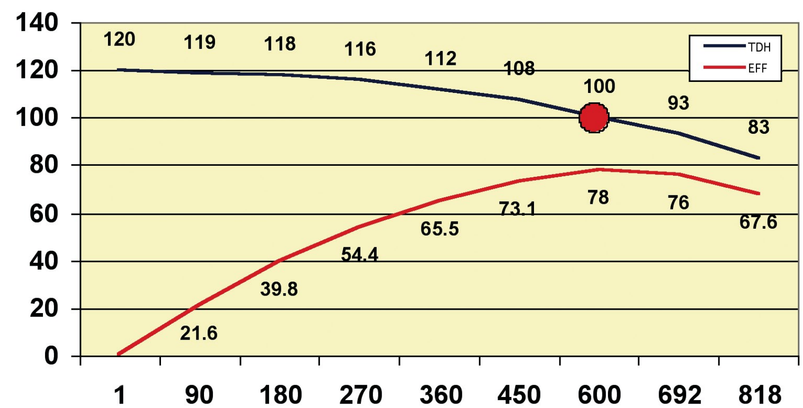
(833/325 = 2.56 Times or 256% Higher Cost)

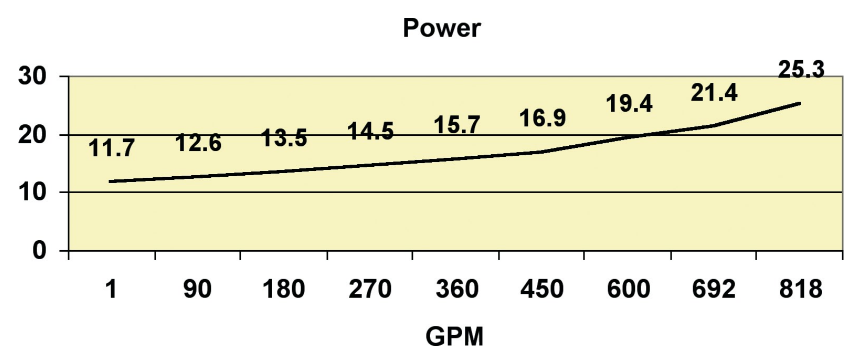
This pump will have to be overhauled 2.5 times more than if it operated at BEP. With an estimated overhaul price of $5500, the operational cost is approximately $13,750 more than it should be.

Redesigning the Impeller and installing a new SIMSITE, re-engineered impeller will save Electrical Costs and more importantly Operational Costs.

Electrical Cost
= $2736 Savings per year per pump.
Operational Cost
= $13,750 Savings per pump.

The new Re-engineered Simsite® Performance Curve will be as follows:
Capacity (GPM): 600 Head(FT): 100 RPM: 1780





Let's next take even larger size, 8x10-17:

Let's assume this pump operates at 2000 gpm (280 feet head), instead of a peak point of 4000 GPM at 240 feet of head. The efficiency at the actual operating point is only 70% instead of the potentially achievable 83% by this pump.

The horsepower at the operating point is roughly 225 hp (168 KW), and the yearly energy bill is:

168 x 24 x 360 x 0.10 = $145,152

The electrical cost to operate the pump would be substantially less if efficiency were increased by re-designing the impeller to operate at the system requirements of 2000 GPM at 280 Feet instead of 4000 GPM at 240 Feet. The efficiency at this new point would be increased to 81%:

$145,152 x (70/81) = $125,440

The electrical savings would be: $145,152 – $125,152 = $20,000 per year, about 13.8 % in this case!

This pump is operating in the system at 2000 GPM at 280 feet instead of 4000 GPM at 240 Feet which is approximately 45% away from the original design point:

(2000/ 4000 = 50% -100
= 50% away from design point)

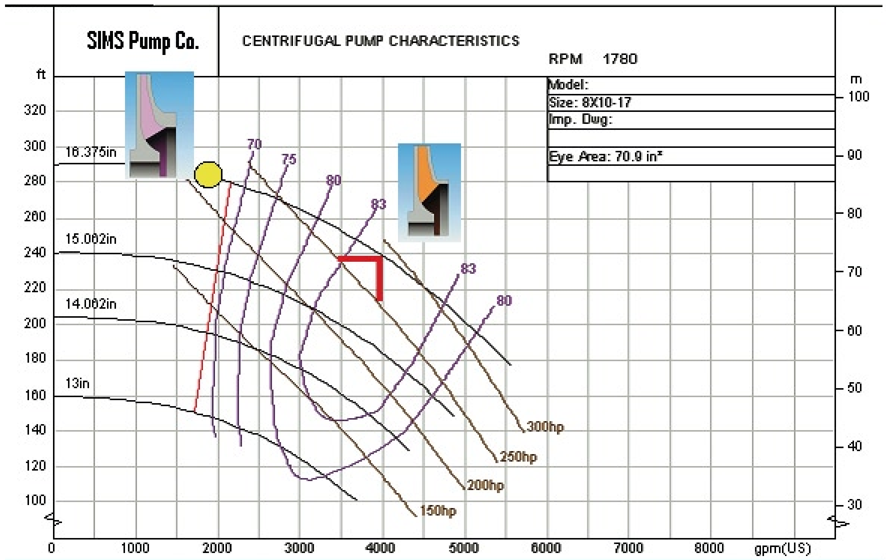
From the chart above, we can determine that when this pump operates 50% away from the original design point (4000 GPM at 240 Ft. like in the example above) the pump failure rate has increased drastically, by 2.56 times!

(833/300 = 2.56 Times or 256% Higher Cost)

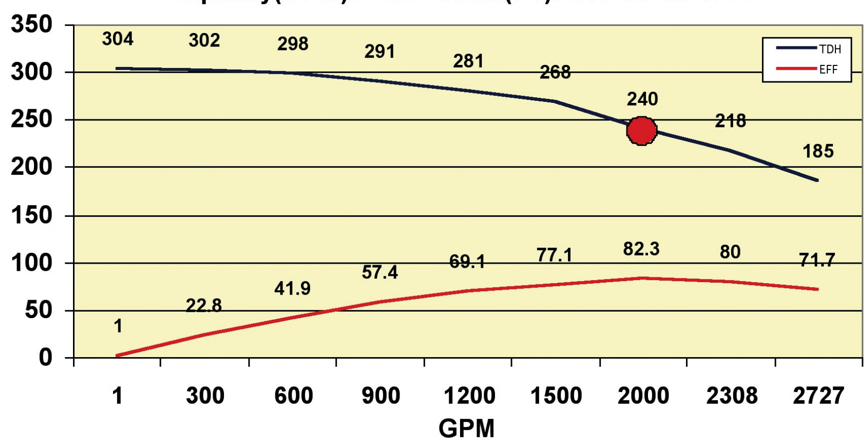
This pump will have to be overhauled 2.78 times more than if it operated at BEP. With an estimated overhaul price of $10,000, the operational cost is approximately $27,800 more than it should be.

Redesigning the Impeller and installing a new SIMSITE, re-engineered impeller will save Electrical Costs and more importantly Operational Costs.

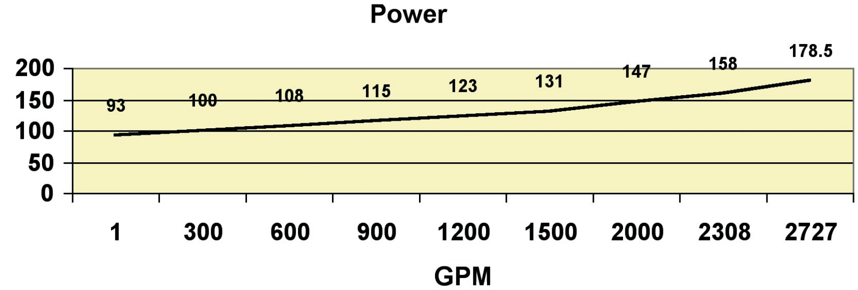
Electrical Cost
= $20,000 Savings per year per pump.
Operational Cost
= $27,850 Savings per pump.



The new Re-engineered Simsite® Performance Curve will be as follows:
Capacity(GPM): 2000 Head(FT): 240 RPM: 1750



Power

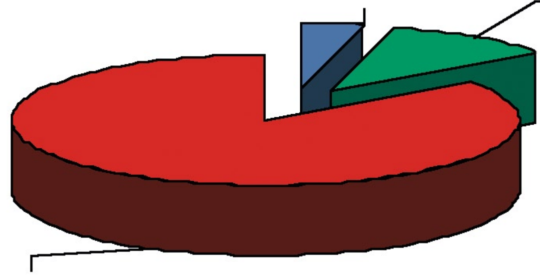


As you can see, the net savings depends on how far away from the Best Efficiency Point the pump operates. Unfortunately, this problem exists in all too many actual installations in the field. Many pumps, purchased and installed years ago, often no longer operate at the originally intended hydraulic conditions. As operating conditions change, the pump is simply throttled further and further away from the BEP. The result – dollars literally "burned up," -- not to mention other problems (high loads, shaft breakage, premature rotating life wear etc.).

Obtaining a smaller pump is not a good answer. First of all, a smaller pump may still not (and usually does not) have the hydraulics sized to hit the operating point "dead on". It may help somewhat, but is expensive and not as efficient. The user choice is limited only to the standard pump sizes available from the pump manufacturer's catalog, and even with a large number of sizes in the catalog, it is virtually impossible to cover each and every variation of the operating conditions. So, the user is forced to settle for the "second best," but not the optimum. More importantly; however, is the issue of economics and feasibility of piping change, to accommodate a proposed pump downsizing. Piping changes alone can often cost more than a pump.

A better solution is to install a new Simsite, Impeller, custom-designed, engineered, and sized for your operating conditions. By doing that, the pump performance will essentially "shift" or "slide" to exactly where the Best Efficiency Point is, - and the net losses and radial loading become zero. Such approach is effective, and the investment is minimal, with a payback of less than a year, and often just a few months.

Not only ANSI or single stage overhung-impeller pump designs can benefit from this approach. Split case and multistage pumps, are known to have benefited greatly with improved impeller hydraulics. When a metal impeller is replaced with structural engineered composite impeller such as - Simsite, (85% lighter then metal), the combined effect of hydraulic fine-tuning with reduced weight (and thus load), can be dramatic. Rotor dynamic benefits of such an approach are obvious, and savings immediate. Other pump types, such as vertical multistage, river intake pumps, condenser, circulating, etc. can have similar issues, and could be likewise retrofitted with improved hydraulics designs, - quickly, efficiency, and economically.



Remember, when you analyze the Total Cost of a Pump over the entire lifetime, you will find the following results:

Only 4% of the Total Cost is the Initial Purchase Price, 85% of the Total Cost is the Operational Cost (Includes the Cost of Energy) and 11% of the Total Cost is Maintenance Cost.

Example:* *A pump that costs $15,000. If you increase efficiency by 5% by installing a SIMSITE® Impeller you will have saved $18,750 (More than the initial cost of the pump)

If you suspect that your pump is not operating at the optimum conditions, - send us your hydraulic curve and indicate the desired operating condition. We will evaluate the potential energy savings, as a function of your operating conditions in relation to the actual pump BEP point. We will then evaluate the costs, and impact of rotor dynamics, and will provide our engineering recommendations. You may be surprised how much money you can save.

Sims
Pump Valve Company, Inc.
1314 Park Ave, Hoboken, New Jersey 07030 USA
Phone 1-800-746-7303 (201) 792-0600
Fax – (201) 792-4803
www.simsite.com