Interpump Supply Ltd.

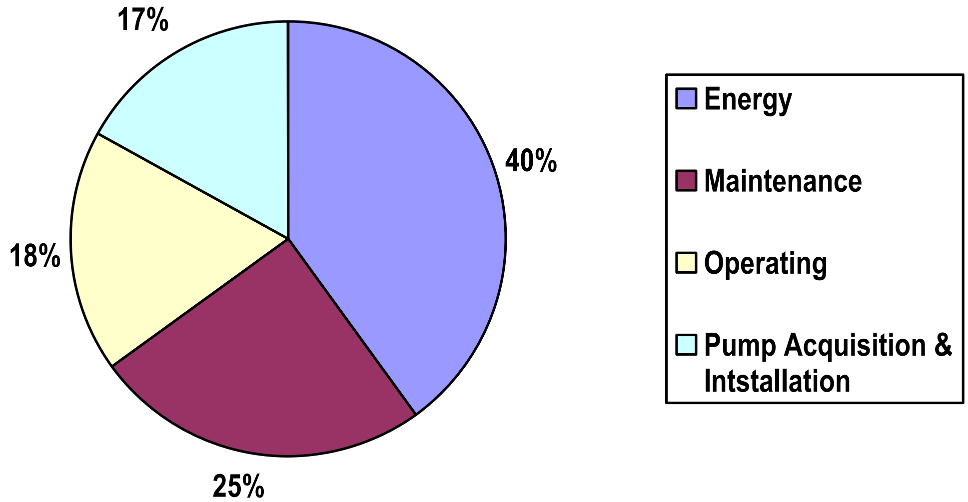
GOULDS AQUAVAR VFD'S

Pump System Optimization and Energy Savings

PUMP LIFE CYCLE COSTS

A Life Cycle Cost (LCC) analysis is a proven management tool to determine and compare the total costs for a project. The chart below highlights total lifetime costs to purchase, install, operate, maintain and dispose of pumping equipment.

Basic Elements of Life Cycle Costs



Traditional methods of specifying and tendering pipe, valves, controls and pumps can result in somewhat lower upfront costs but often produce much higher energy and maintenance costs. Most water facility pumping systems have life cycle costs dominated by energy and maintenance. Studies have shown that in many cases, a considerable portion of the energy consumed by pump systems could be saved through piping, equipment or control system changes.

Minimizing life cycle costs may require trade-offs between elements, such as paying a higher initial cost to reduce overall maintenance, energy and lost production.

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PUMP SYSTEM OPTIMIZATION

Pump system optimization involves the process of understanding and eliminating costs that inhibit improvements in reliability, productivity, profitability and reduced maintenance. As well, it identifies energy savings as the greatest area for potential savings. Overall, it is estimated that 25% of industrial motor system energy is consumed by pump systems and that it represents 20-60% of all energy consumption in many industrial, water and wastewater treatment facilities. Properly designed pump systems will result in not only lower energy costs, but reduced down time along with an increase in both the life of the pump and the system as a whole.

Benefits of Pumping System Optimization

Improve

- Profitability
- Staff productivity
- System reliability
- Product quality
- Worker safety

Reduce

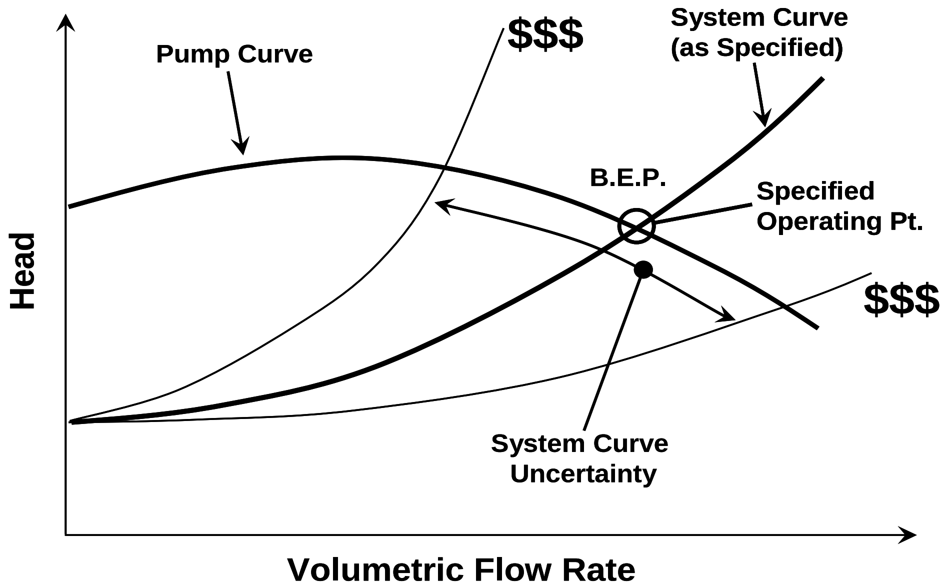
- Energy costs
- Production costs
- Waste Disposal costs
- Emissions
- Maintenance

Symptoms of a Suboptimal Pumping System

- Existence of throttled flow control valve
- Existence of bypass line flow regulation
- Frequent on/off cycling of pump in a continuous process
- Presence of cavitation noise at pump or elsewhere in system
- A parallel pump system with the same number of pumps always operating
- A pump system with no means of measuring flow, pressure or power

COMPARE SYSTEM CURVE WITH PUMP PERFORMANCE CURVE

A well designed pump distribution system must meet the performance needs of the individual operating conditions. In some cases, proper sizing can potentially allow for the selection of a smaller pump and motor. This will result in both reduced initial costs and, more importantly, associated life cycle costs. In order to maximize efficiency, pump systems should operate as close to the Best Efficiency Point (BEP) as possible.



Benefits of Running a Pump near BEP

- Smooth pump operation
- Minimum internal circulation
- Reduced bearing and mechanical seal failure
- Reduced cavitation damage
- Minimal vibration
- Reduced noise
- Reduced discharge pulsation

THE SOLUTION: GOULDS AQUAVAR VARIABLE FREQUENCY DRIVES

Using control methods to reduce the power needed to run pumps during periods of reduced demand can have a significant impact on reducing pump life cycle costs. An Aquavar variable speed pump controller is a pump specific drive that will vary the speed of the pump according to performance conditions in order to maintain a constant pressure, flow, temperature or level.

The potential for energy savings as flow requirements change is significant. For centrifugal pumps, the performance of the system can be determined by using the 'Affinity Laws'. By referring to the curves in Figure 3 below, we can see the theoretical load requirements and potential energy savings. The first curve shows that rate of flow varies linearly with speed. When pump speed is decreased 50%, the flow decreases to 50% as well. The second curve shows that head varies as the square of speed. If we go to 50% speed, we will have 50% flow but only 25% of the head based on this relationship. The third curve shows the power required for a particular flow requirement. For this we can see that energy varies as the cube of speed. Again if we set the speed to 50%, we have 50% flow at 25% head and are consuming only 12.5% of the energy.

Figure 3

$$\frac{Flow_1}{Flow_2} = \frac{RPM_1}{RPM_2} \qquad \frac{Head_1}{Head_2} = \left(\frac{RPM_1}{RPM_2}\right)^2 \qquad \frac{Power_1}{Power_2} = \left(\frac{RPM_1}{RPM_2}\right)^3$$

In addition to the substantial energy savings, Aquavar drives will also;

1. Increase operating control and flexibility
2. Protect the pump from cavitation, dead head and blocked suction
3. Protect the motor from short circuit, phase loss, overload and voltage fluctuations
4. Enhance user interface and system integration
5. Provide soft starting and stopping
6. Reduce equipment wear
7. Reduce damage to piping infrastructure due to water hammer

For more information on Aquavar VFD's, please contact us here at Interpump Supply or refer to www.goulds.com