OPTIMIZING PUMPS AND PUMP SYSTEMS

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Key Points

Equalize flow over production cycle using holding tanks.
Install parallel systems for highly variable load, or install a larger pump with speed controls.
Variable frequency drives allow pumps to operate at near top efficiency.

Today's business environment of globalization, increased competition and expanding regulations has forced many businesses to cut operating costs. While investment in cost-saving software and other technology has been significant, little attention has been paid to the continued use of outdated, inefficient motors. Pump systems, in particular, offer opportunities for optimizing production processes in a wide variety of industrial and commercial enterprises. Many proven strategies exist for optimizing pump system performance. The range of potential energy savings can be 20% to 50%.

Optimizing Pumps and Pump Systems

The U.S. Department of Energy's Motor Challenge Program highlights a number of specific energy-efficiency measures for pump systems. These are listed in the table below, along with energy savings estimates.

Reduce Overall System Requirements (do not assume requirements are fixed)

- Equalize flow over production cycle using holding tanks (10% - 20% savings)
- Eliminate bypass loops and other unnecessary flows (10% - 20% savings)
- Reduce “safety margins” in design system capacity (5% - 10% savings)

Match Pump Size to Load

- Install parallel systems for highly variable load, or install a larger pump with speed controls (10% - 50% savings).
- Reduce pump size to better fit load (pumps are routinely oversized by 15% to 25%).
- The Hydraulic Institute recommends using two or more smaller pumps instead of one larger pump so that excess pump capacity can be turned off.

Reduce / Control Pump Speed

- Reduce speeds for fixed loads — trim impeller, lower gear ratio.
- 82% of pumps have no load modulation.
- Studies cite savings of 75% in food processing.
- Replace throttling valves with speed controls to meet variable loads.
- Adjustable speed drive installations show savings of 30% - 80%. These savings only apply to circulating pump systems (not systems with static heads).

Improve Pump Components

- Replace typical pumps with most efficient model, or one with an efficient operating point better suited to the operating flows. 16% of pumps are older than 20 years old.
- The problem is not the age of the pump, but that the process has changed over time (10% - 25% savings).
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Operation And Maintenance
Replace worn impellers, especially in semisolid applications. Inspect and repair bearings, lip seals, packing and other seals. Pump efficiency degrades from 1% - 6% for impellers less than maximum diameter, and with increased wear-ring clearance. The Hydraulic Institute recommends maintaining pumps and all system components in virtually new condition to avoid efficiency loss.

Use pumps operating as turbines to recover pressure energy that would otherwise be wasted.

Friction Losses
In the fluid system, unnecessary friction can increase energy use. In a system that is already designed and built, controlling friction caused by pipe size or roughness is nearly impossible. However, operators can improve friction inefficiencies caused by piping components, unnecessary flow paths and high flow rates. Throttle valves, in particular, are associated with friction losses. Measurements can be taken to determine efficiency loss through friction. Loss coefficients are published by the Hydraulic Institute or by valve manufacturers.

Variable Frequency Drives
Traditionally, control valves were used to control fluid flow in pumping systems. Increasingly, variable frequency drives are being used, especially with intelligent drives. VFDs allow pumps to operate at near top efficiency and protect the system from mechanical damage when they do not. With VFDs, pumps can run at slower speeds with trimmed impellers, thereby increasing system reliability and decreasing failure rates. In new applications, VFDs are normally less expensive to purchase and install than control valves. The reduced energy and maintenance costs associated with VFDs make them a good fit for retrofits in older pump systems as well.
Other Savings Opportunities

In addition to the improvements mentioned above, other measures for reducing pump system components include adjusting the system flow paths, trimming the pump impeller, and adding a gear reducer and a two-speed motor to the existing pump system.