PUMPS THAT EXPERTS SELECT.

Life Cycle Costs

Life Cycle Costs

- SKF Reliability Systems- www.skf.com
- Rockwell Automation- www.rockwellautomation.com/entek
- Shows that 15-40% of indirect costs of a plant are spent on maintenance with about 50% of that estimated to be unnecessary
- By switching from reactive to predictive maintenance, maintenance, repair, and operations inventory costs can be reduced by as much as 30%
- The Maintenance Cost Index (MCI) is cost of maintenance divided by the asset value. At top plants it is under 2%, while many plants operate closer to 4%
- There are five key areas
  - Vibration analysis
  - Lubrication analysis
  - Infrared thermography
  - Electrical motor analysis
  - Ultrasonics

  (www.mhm.assetweb.com)
- Hardy Instruments, www.hardyinstruments.com has the HI 3600 machine monitor

Example One (20hp pump rated at 1250gpm at 40 ft tdh)

This is an example of a system that has extreme variation in flow requirements

System Gpm	System Head	Oper Cycle Gpm	Oper Cycle Hours	Op. Costs Fixed Speed	Op. Costs VFD	Savings/yr.
100	10.4	200	5880	158,571kW	19,436kW	
500	12.9	350	1260	$4,439/year	$544	$3,895
1000	20.5	1250	1260			88%
1500	33.8					

Example Two (Qty 2 300hp pumps rated at 15,000gpm at 74 ft tdh, 2 pumps run 1 standby)

(In this example there was 25% excess flow being pumped than what the system needed)

Trimming the impellers from 27.5in to 26.2in

27.5in	26.2in	Savings/yr/pump		Savings 2 pumps	
1,873,600kWh/pump	1,401,600kWh/pump				
$52,460/pump	$39,244/pump	$13,216	25%	$26,432	25%

The above using VFD in lieu of impeller trim

Fixed	Variable	Savings/yr/pump		Savings 2 pumps	
1,873,600kWh/pump	765,880kWh/pump				
$52,460/pump	$21,444/pump	$31,016/pump	40.80%	$62,032	40.80%

Example Three (pump was rated for 3500gpm at 147 ft and the system only allowed 2880gpm at 156.5 ft)

De-bottleneck of the discharge piping system from 6 in to 8 in allowed to gain 600 gpm flow

	Present System	De-bottlenecked
Sys Curve	2500gpm at 128 ft	2500gpm at 81 ft
	3000gpm at 182 ft	3000gpm at 111
	3500gpm at 239	3500gpm at 147

Op. Point	2880gpm at 156.5	3493gpm at 133.6

Example Four (pump rated at 4080gpm at 30 ft tdh with butterfly valve to control flow, sometimes closed 95%)

Here the valve has to be replaced ($18,000) every 7 years therefore the annual cost is $2,600 for the valve

Fixed	Variable	Savings/yr	Maint Savings	Total Savings	
258,617kWh	187,820kWh				
$3,620	$2,629	$991	$2,600	$3,591	100%

Example Five (four pumps in parallel 25,000 ft of 20 in pipe, pump rated at 3200gpm at 1196 ft tdh)

Constructing a parallel line would reduce the dynamic friction to 131 ft and increase system flow from 12,800gpm at 14,600gpm

Present System				Proposed Parallel System			
Flow	TDH	Static	Dynamic	Flow	TDH	Static	Dynamic
12800gpm	1180ft	433ft	747ft	14,600gpm	564ft	433ft	131ft

Energy Costs/Yr(12,800 gpm at 1180 ft tdh)	Energy Cost/Yr(14,600gpm at 564')	Savings/yr	Demand Charges
$872,000/yr	$480,000/yr	$392,000/yr	$113,000

Total Savings= $392,000+ $113,000= $505,000/yr or a 57.9% savings(not included is the cost of the pipe)

Example Six (Two cooling water 100HP, 5,700 gpm at 57 ft tdh operating in parallel with one throttled)

One pump is allowed to run at full capacity and the other is throttled manually

Throttle Flow	**Pump#1**	**Pump #2**	**Total 2 Pumps**	
Energy Consumed/yr.	0.690GWh	0.575GWh	1.265GWh	
Annual Energy $$	$19,350/yr	$16,100/yr	$35,450/yr	
Variable Speed	**Pump#1**	**Pump #2**	**Total 2 Pumps**	
Energy Consumed/yr.	0.30GWh	0.30GWh	0.60GWh	
Annual Energy $$	$8,500/yr	$8,500/yr	$17,000/yr	
Energy Savings	**Pump#1**	**Pump #2**	**Total 2 Pumps**	
Energy Savings/yr	0.39GWh	0.275GWh	0.665GWh	
Energy Savings $$/yr	$10,850/yr	$7,600/yr	$18,450/yr	52% reduction

Example Seven (A 1,500HP pump rated at 27,000gpm at 170 ft tdh, with system requirement of 27,000gpm at 100 ft tdh)

The 70 ft of excess head is dissipated across a gate valve. The pump and motor were oversized by 500HP, therefore the motor was slowed down to save 3.2GWh of energy savings per year.

	Consumption	Cost/year	
Present System	8.9 GWh	$249,690	
Modified System	5.7 GWh	$158,900	
Energy Savings	3.2 GWh	$90,790	
Demand Savings	475 hp	$27,500	
Total Savings		$118,290	47.3% savings

Example Eight (Two 125HP pumps running at 437 gpm at 700 ft tdh for a system requirement of 650 gpm at 700 ft tdh)

Originally one pump was to run and the other was for standby, but with increased production both pumps were needed.

In this case after analyzing the system, it was determined that increasing the impeller diameter and motor to 150HP. Went from 125 to 150HP motors and impeller change from 13.25 in. to 13.75 in. diameter.

	Present System	Larger Impellers	Annual Savings

Energy Cost/yr	$40,234/yr	$26,613/yr	$13.621/yr
Demand Cost/yr	$12,960/yr	$8,530/yr	$4,430/yr
Total Electrical Cost	$53,194/yr	$35,143/yr	$18,051/yr 66%savings

Example Nine (Rebowling an oversized 125HP pump rated at 1000gpm at 315 ft tdh, the system needs 650 gpm at 230 ft tdh)

Presently the 1000 gpm pump is throttled back to 650 gpm at 420 ft tdh

	Present	Throttled	Rebowled	
Energy Cost/yr $$	$48,000/yr	$40,000/yr	$22,300/yr	46.4% savings

In this case the rebowl cost $4,560 so the pay back was 2.5 months

Example Ten (Smart Pump Technology)

Pump Smart System realizes $275,445 in "Total Life Cycle Cost Savings."
Initial Cost
Installation Cost
Maintenance Cost
Operating Cost
Eliminates: flow control valves, starters, recirculation piping, flow meters