LINKING ENERGY & RELIABILITY

YOUR KEY TO SUSTAINABILITY

William C. Livoti
Senior Principal Engineer
Baldor Electric

Sustainability

Sustainable business growth strategy is a practical approach to achieving top-line growth and bottom-line results.

“ What use is a sawmill without a forest? “

Herman Daly

Current Reality

- Sustainability is the biggest opportunity and challenge that industry faces
- Developing a strategy to take on sustainability is vital for the long term survival of industry
- How can industry get past first cost and the paralyzing fear of change? One thing we can’t get past is rising energy cost
- Since 1999 average energy rates have increased 50% for industrial and 30% for commercial businesses in the Northwest, other regions of the U.S. have experienced similar cost increases.

State of the Power Industry

- Unrelenting growth in power consumption, demand for energy is expected to grow 30% by 2030, the US will need to build 151 gigawatts of new power generation by that time
- A switch to cleaner energy sources
- Pollution control efforts and pent-up demand for new generation sources after a slowdown in new plant construction have all combined to create a boom in power plant building
- The power plant boom will continue because of this demand, even with a credit crisis
- Total power construction spending last year reached $53.4 billion, a 34 percent increase from $39.8 billion in 2006
- Focus on improving efficiency (Asset Management)

The overall picture is that the electric power industry faces a situation in which significant investments are needed, and rate increases will be necessary to finance them.

Making the Business Case

- While it is important to negotiate the best price per kW/hr for electricity investment in energy efficiency is not only about obtaining the cheapest source of new power for business.

- Cost savings through energy efficient systems, waste reduction, reduced risk, and increased workforce productivity will allow industry to achieve sustainability.

- For the skeptics there is a very compelling business case for investment in energy efficiency.
  - Build new fossil plant (capital cost) $1,100 per kW/hr
  - Renewable (capital cost) $1,208 per kW/hr
  - Energy efficiency @ 2.4 cents per kW/hr

Where is your company, state, our country going to be with twice the energy foot print of others?

As companies, if we do not take environment seriously we won't be around

CASE STUDY

Well Water System

250hp Hollow Shaft Motor
Eddy Current Drive

Well Water System

Case Study:

- Well system installed in May 1975
- (2) separate installations designated 1B and 1A.
- Subject units are vertical, six stage turbine style pumps. Coupled to 250hp hollow shaft motors through an Eddy Current Drive.
- The pumps develop 310 ft head @ approximately 1700gpm when operating at base speed of 1717rpm.
- The system generally operates in the 1200 to 1700 rpm range, however, under extreme conditions the pumps can run at a higher rate/ speed.
- The well pumps feed water into several areas of the plant.

System Configuration

- According to the plant P&ID's the well pumps send water into the water treatment facility
- Upon entering the facility the pressure is reduced to 25psi by valve PRV-1 and PRV-2, flow is then directed to the clear well and flush water and chlorination systems
- Therefore, it is assumed (and verified) the treatment plant only requires a maximum of 25psi through the 8" line feeding the plant. Using the pump affinity laws and allowing for friction loss the pump speed can be reduced to approximately 750rpm. This speed change would eliminate the need for excessive throttling of valves PRV-1 and PRV-2. Slides 10, 11 and 12 indicate the annual cost of friction when throttling said valves at specified operating points. All savings calculations are based on operating at specified points 50% of the time @ 10 cents per Kw/hr (national average).

System Data

Amperage reading over a range of operation as well as piping P&ID's were supplied by plant personnel. Based on this information as well as verbal description of how the system operates the following data was compiled:

Operating performance / savings with upgraded motor and drive:

- 1200rpm
- 1500 rpm
- 1717 rpm

Energy/Friction loss across PRV-1 and PRV-2

Recommendations for System Optimization

Recommendations to improve MTBR of pump

Potential energy savings for clear water and flush water systems

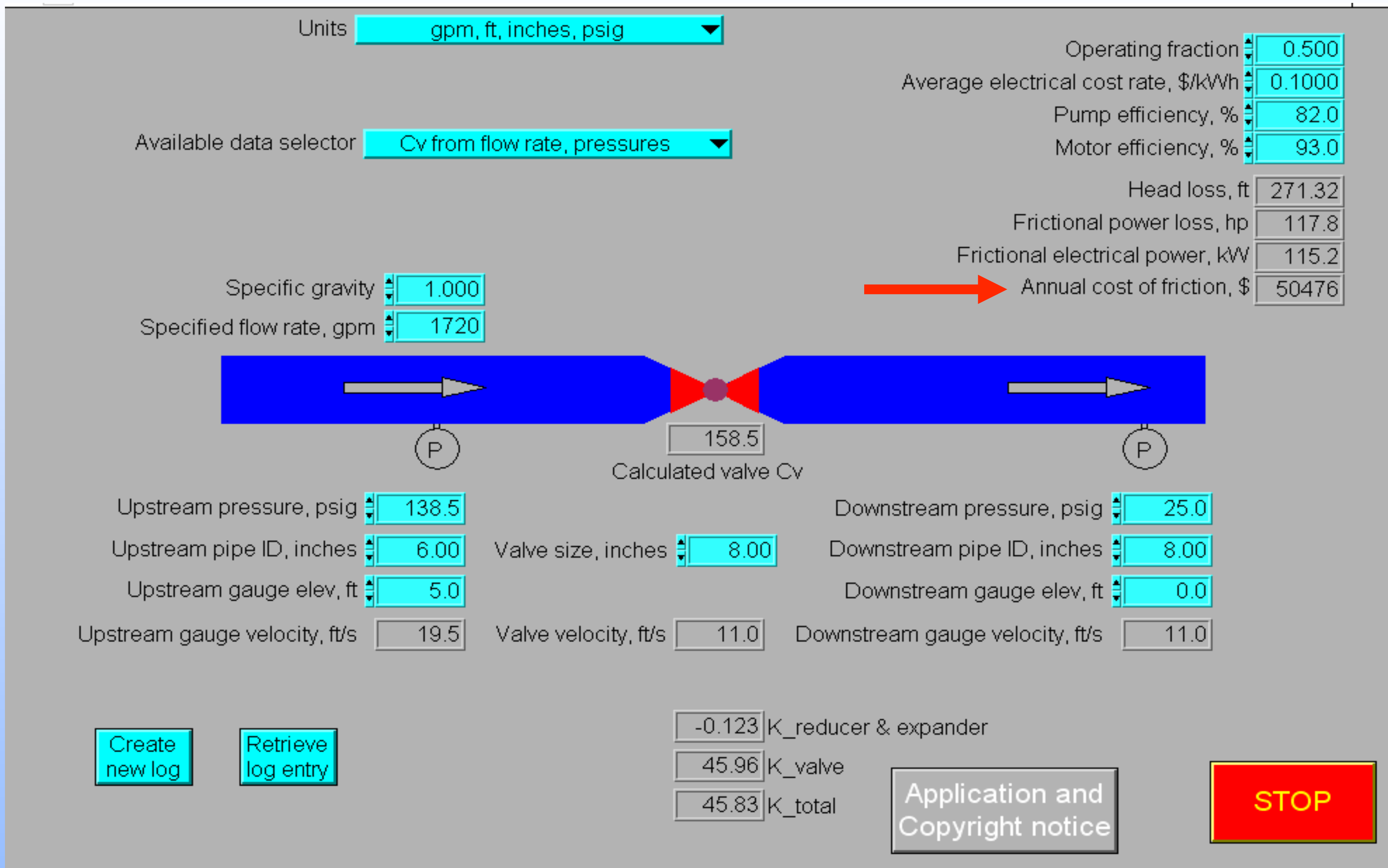
Maintenance History

- Frequent drive failures MTBR 1 year ($5K) = $160,000
- Pump MTBR 2.5 years ($15K) = $192,000
- Motor repair 2.5 years ($2K) = $25,600
- Lost production $ = ?
- Maintenance / Labor = 16 hours x 2 = 32 man hours x $45 = $1,440

$160,000
$192,000
$25,600
$1,440
$379,040 / 12 = **$31,586** per year

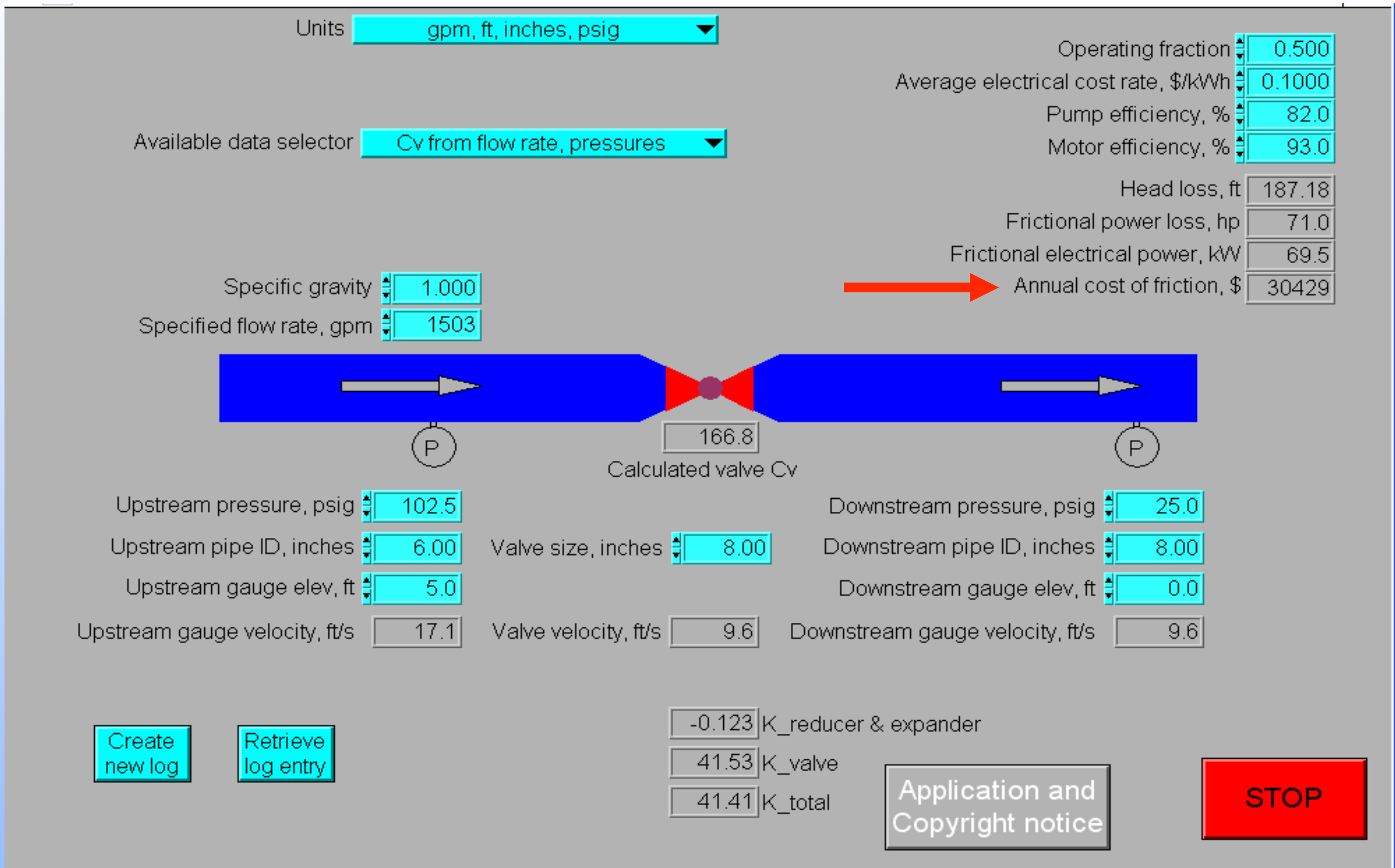
Energy (1) year @ .10 Kw/hr = $162,750 + $31,586 = **$194,336**

PRV 1



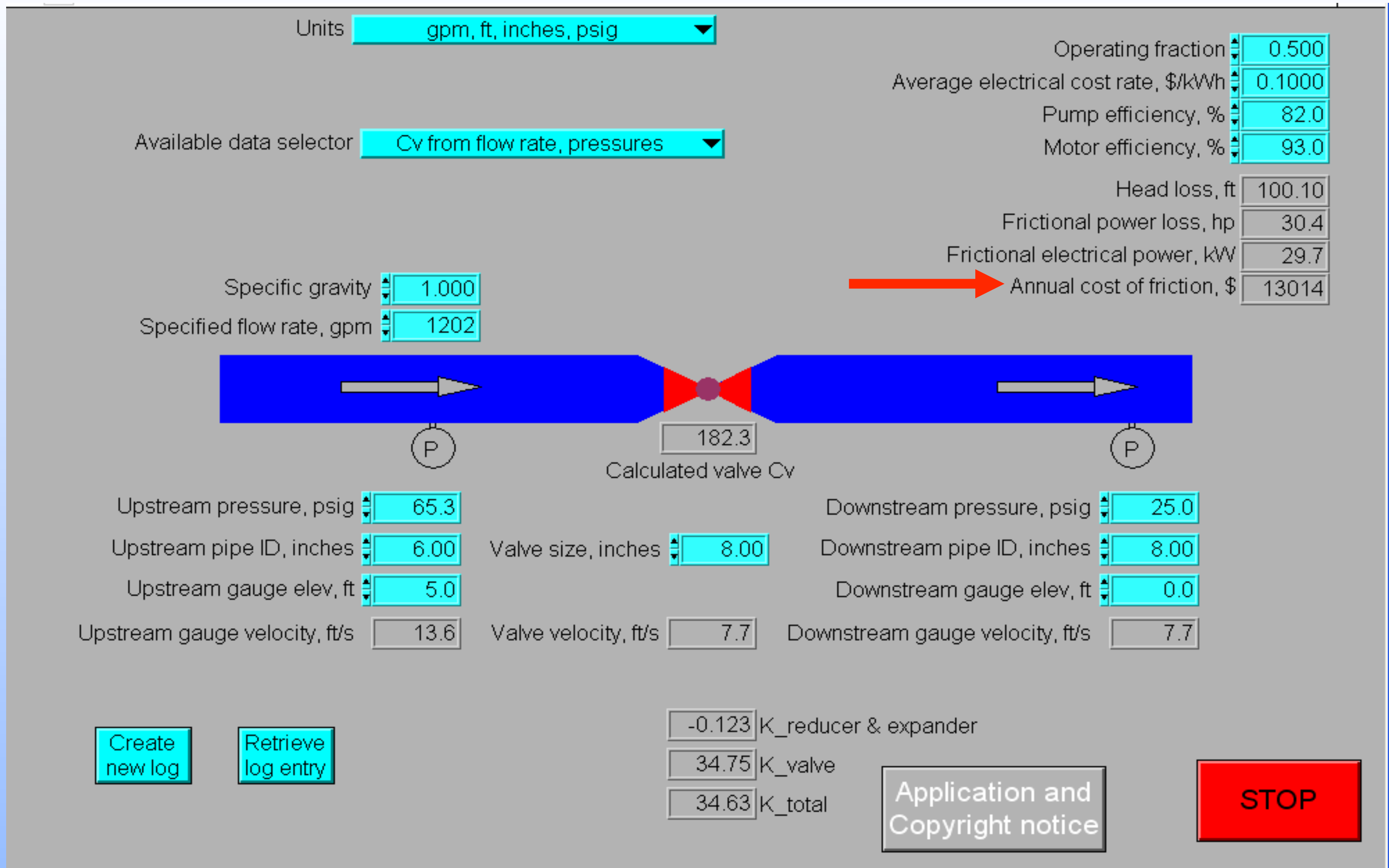
1717 RPM 310 Ft/head @ 1720 GPM 160hp

PRV-1



1500 rpm BEP 237 Ft/Head @ 1503 gpm 107hp

PRV-1



1200 rpm BEP 151 Ft/Head @ 1202 gpm 55hp

Maintenance & Reliability Technology Summit

Recommendations

- Replace existing motor with solid shaft premium efficient design
- Modify pump shaft to accept solid shaft motor/coupling
- Replace existing Cutlass rubber pump line shaft bearings with Polymer (low coefficient of friction) type material
- Replace Eddy Current Drive with PWM VFD

Savings

Maintenance per unit: $31,586.00 (per year)

Energy per unit:

- Premium Efficient Motor - $5,861.00 (95.80%)
- Friction Loss - $31,306 (average over three operating conditions)

Total Savings per year = $68,753 x (2) units = $137,506.00

Conclusion

- Sustainability is the biggest opportunity and challenge that industry faces
- Change is inevitable
- Developing a strategy to take on sustainability is vital for the long term survival of industry.
- Look beyond energy savings, attach dollar values to non-energy benefits
  - **Increased productivity**
  - **Reduced costs of environmental compliance**
  - **Reduced production costs**
  - **Reduced waste disposal costs**
  - **Improved product quality**
  - **Improved capacity utilization**
  - **Improved reliability**
  - **Improved worker safety**

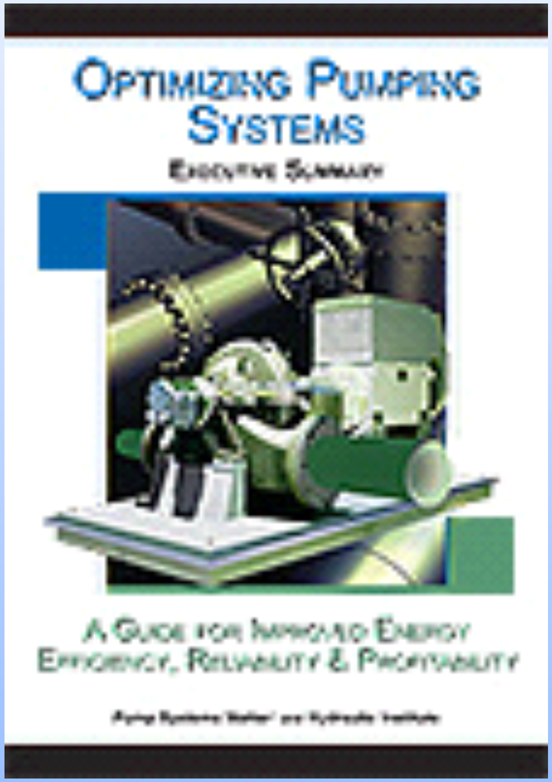
Incentive Programs

DSIRE
Data Base for State Incentives for Renewable Energy and Efficiency

http://www.dsireusa.org/

Reference / Resource Material

www.pumpsystemsmatter.org
www.pumps.org
www.baldor.com



Free Tools:

- PSIM Pump System Improvement Modeling Tool
- Valve Tool (DOE Best Practices)
- PSAT (DOE Best Practices)
- BE$T Program (Baldor Energy Savings)

QUESTIONS