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Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Company: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Draw a diagram of one of your pumping systems you think may have energy saving potential.
   1. Include the pump make, model and horsepower if possible.
   2. Try to find the pump curve.
   3. Include the valve types, sizes, and typical positions.
   4. Estimate the pipe lengths and sizes.
   5. What is the typical system flow and the pump suction and discharge pressures?

**Example Diagram**

A picture containing text, screenshot, diagram, line

Description automatically generated

***Go the Extra Mile: If you have time work through some of the following!***

***Answers are on the Next Page.***

1. If a plant’s net cost of electricity is $0.12/kWh and their pumps typically operate 60% of the time, what is the minimum motor size on a pump that will cost $20,000/year to operate? Hint: see slide 20.
2. The flow control valve on a boiler feedwater pump typically operates 50% open with a flow rate of 200 gpm of water going to the boiler at 250 F. Plant engineers measure a pressure drop of 115 psi across the valve. If the pump efficiency is 72% and the motor efficiency is 92%, how many kW in motor input energy is being dropped across the valve?
3. If the boiler feedwater pump in #3 above operates all the time and the cost of electrical energy is $0.065/kWh and the demand charge is $14.75/kW-mo, how much does the energy loss across the throttled valve cost the plant per year?

***Answers***

1. Answer: 40 hp (from slide 20)
2. Answer: Density of water at 250 F is 58.82 lbm/ft3; the density of water at 60 F is 62.36 lbm/ft3; so, the specific gravity is 58.82/62.36 = 0.9432.

The head loss across the valve is: HL = (115 psi x 2.31)/0.9432 = 281.65 feet

The kW of pump motor power lost across the valve is:

kW = (200 gpm x 281.65 feet x 0.9432 x 0.746 kW/hp)/(3960 x 0.72 x 0.92) = 15.11 kW

1. Answer: Energy Cost = (15.11 kW x 8760 hy/yr x $0.065/kWh) = $8,604/yr

Demand Cost = (15.11 kW x $14.75/kW x 12 mo/yr) = $2,674/yr

Total Annual Cost = $11,278/yr