Purpose

This document provides more specific and additional guidelines for an industrial plant Energy Efficiency Feasibility Study where pumps are the targeted system. The intent of these guidelines is to help identify the availability of innovative and implementable energy savings opportunities. It is not intended to be prescriptive in defining all study procedures and methods.

Scope

This is not a stand alone document as it outlines additions and pump-specific modifications to the general guidelines document BCH-QMS-9462-C-001 “Guidelines for an Industrial Energy Efficiency Feasibility Study” for a pump system Energy Efficiency Feasibility Study. BCH-QMS-9462-C-001 and this document should be reviewed together.

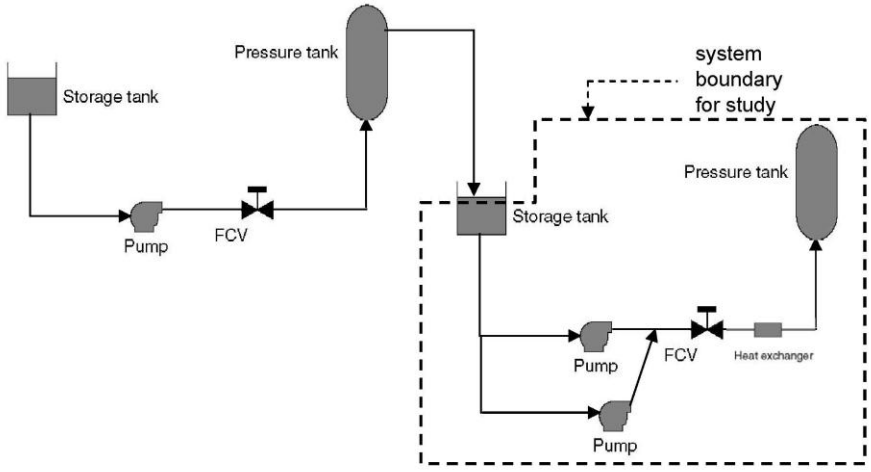
Guidelines

NOTE: the numbering system for this document provides additions and clarifications to sections in the master document BCH-QMS-9462-C-001, and therefore paragraph numbers in this document are not necessarily sequential.

4. Mechanical and Process System Descriptions – Per Energy Conservation Measure

4.1 Describe the system and areas served using simplified process flow diagrams. Include all major components of the system (pumps, valves, tanks, heat exchangers, etc.) In the process diagram, define the physical boundary of the system being studied (e.g. with a dashed or colour-contrasted line). Also include a more detailed P&ID (process and instrumentation diagram) in the report appendix. Document the actual or expected flow (or flow range), suction pressure, and discharge pressure for each pump.

Sample of a simplified pump system diagram



4.2 Describe all significant connected equipment within the system or process. Include the nameplate data for pumps and motors, and other significant equipment (e.g. heat exchangers) within the system being studied.

4.4 Where process data is provided, identify whether the data is from plant instruments or test instruments used by the consultant.

4.5 Using the best available information, document the actual or estimated operating profile for all pumps in the system being studied as per the following sample table.

Sample pump operating profile for a 1000 gpm pump

hours per year (alternately % of annual hours)	volume flow rate (inferred from amps, flow data, speed, valve position, or other means)	suction head, feet of water (psig or kPa)	discharge head, feet of water (psig or kPa)
1060	shut off	n/a	n/a
1200	500 gpm (50% capacity)	10	130
2000	700 gpm (70% capacity)	12	150
1500	850 gpm (85% capacity)	15	165
3000	1000 gpm (100% capacity)	15	190

4.6 Provide equipment and system efficiencies. Include pump and system resistance curves and pressure changes in the system. Note any system effects.

4.7 Provide equipment data sheets for all equipment including pumps, control valves, motors and variable speed drives (VSD).

4.8 Clearly state the control system and operation strategy. Note the location and operating positions of any flow and pressure control valves in the system and their typical operating position. Describe any recirculation loops in use, parallel pumps, as well as any existing variable speed controls. Document the make, model, and size of the flow and pressure control valves.

4.9 Document any relevant operation and maintenance (O&M) issues, including noise and vibration. Any pump systems described by the plant staff as high maintenance and/or poor reliability should be identified.

5. Analysis

5.1a BC Hydro requires a “systems approach” be employed. In general, this means considering all relevant components (pumps, tanks etc.) that significantly affect the pump operation. Further description of a “systems approach” is provided in

the report “Improving Pump System Performance - a sourcebook for industry” [1] in the Suggested References.

5.1b Where pump performance measurements are part of the study method, measurement methods, instrumentation, and test conditions should be well documented. Any special conditions that may affect performance test results should be described, including conditions that might result in exceptional measurement errors.

5.1c Review with BC Hydro’s customer (plant) technical contact to discuss specific energy conservation measures for each pump system they want assessed, and any specific measures which are not of interest (e.g. measures that were studied in the past, but found to be infeasible due to operating constraints). Include specific energy conservation measures requested by BC Hydro’s customer, unless there is evidence to suggest the specific measure is not technically or economically viable. Similarly for specific measures which are not of interest, exclude these measures unless there is technical and/or economic evidence to study these measures.

5.2 Describe the modifications that will achieve energy efficiency in the pump system including as applicable: improvements in the efficiency of the motor, pump (define the “pump system” boundary), change in operating profile, pump controls, changes in operating profile, and/or reduced system resistance.

5.5 Describe the analysis methodology and data with sufficient detail that another engineer, given sufficient time and resources, could approximately reproduce the results. Make note of any software and software version used in the analysis. In general, BC Hydro does **not** recommend the use of the U.S. Department of Energy Pump System Assessment Tool (PSAT) for pump system energy efficiency feasibility studies.

5.7 Describe the basic elements of a measurement and verification strategy for each recommended energy conservation measure.

8. Implementation Strategy and Schedule – Per Energy Conservation Measure

8.3 Comment on any risks (e.g. lost production, reliability) associated with the implementation of each energy conservation measure.

Suggested References

1. Improving Pumping System Performance - A Sourcebook for Industry (2nd edition) http://www1.eere.energy.gov/industry/bestpractices/motors.html
2. Volk, M. (2005) Pump Characteristics and Applications (2nd edition).
3. Variable Speed Pumping: A Guide to Successful Applications (2004). http://www1.eere.energy.gov/industry/bestpractices/motors.html
4. Guidance for Draft Standard for Trial Use: EA-2-2008 Energy Assessment for Pumping Systems (American Society of Mechanical Engineers) http://www.cee1.org/files/ASMEEnergyAssessmentforPumpingSystemsGuidancev0.2.pdf