Getting Smart

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The Salim water treatment plant in Indonesia uses intelligent VFDs to control the lead-lag operation of these new replacement pumps. On the left is the surge valve that replaced the surge vessel to avoid water hammer.

The Sibu Water Board (SWB) maintains three plants in Malaysia – Bukit Lima, Salim and Sibintek – with a total production capacity of 34-mgd.

The Salim plant is the first waterworks plant in Malaysia to receive ISO 9001 certification. Its mission is to provide a safe, reliable, competitively-priced quality water supply and service to its customers, co-workers and shareholders.

In reviewing options to improve its operations, SWB determined that an automatic demand-regulation pumping system would have a substantial effect on the bottom line of the plant.

Because most traditional waterworks plant designs in the past selected larger pumps and valves to compensate for anticipated peak demands or future expansions, the conventional wisdom used oversized pumps and fixed process set-points that burned unnecessary energy. All of these selections were made without regard to the total life cycle costs of the system.

Two years ago SWB selected a local distributor, Group Engineers Malaysia Sdn Bhd (GEM), to work with them in developing a more effective solution to handle the demand of their pump system operations. Working with ITT Goulds Pumps (Seneca Falls, NY), the SWB team conducted numerous site and system studies, held discussions and attended seminars to understand exactly how an automatic demand regulating system would function.

The SWB team finally selected three PS200 pumps for the first phase of the plant improvement process. These pumps use PumpSmart® variable frequency drives (VFDs) embedded with pump intelligence to give the SWB team an automatic demand regulation pumping system that trims the performance of the pumps electronically, instead of the conventional method of physically trimming the impeller.

Layout of the pump controls (on left) and harmonic filters (on right).

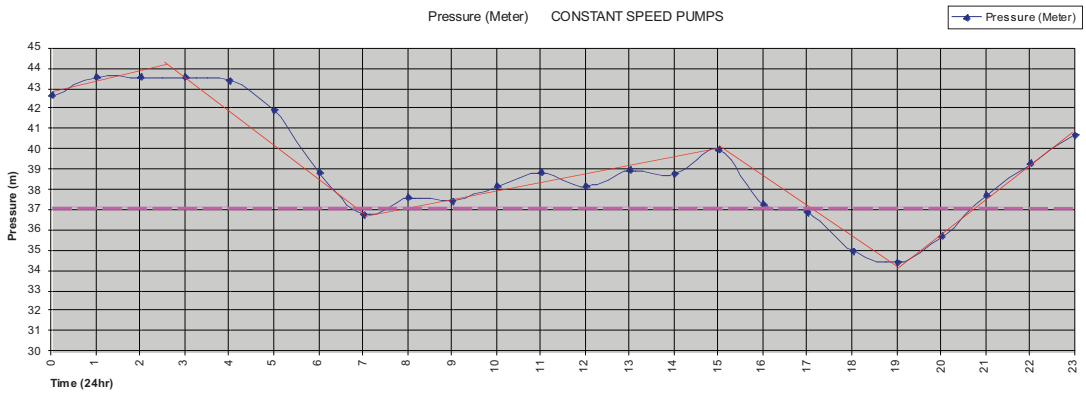

Figure 1. Pressure readings before introducing new system.

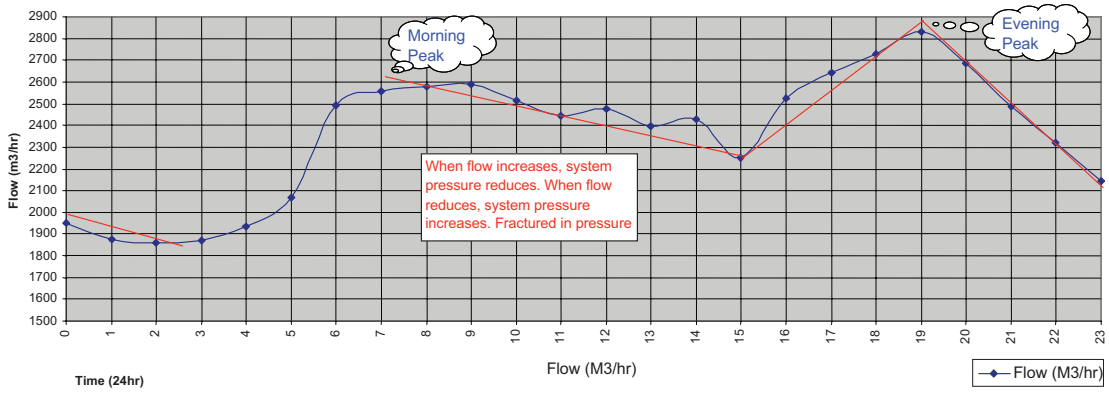

Figure 2. Before the new system was introduced: During high peaks, the pressure output decreases and does not meet the customers' pressure needs. During low peaks, the pressure is over-demanded, resulting in high power consumption, as well as increased wear and tear of pump, valve, and system.

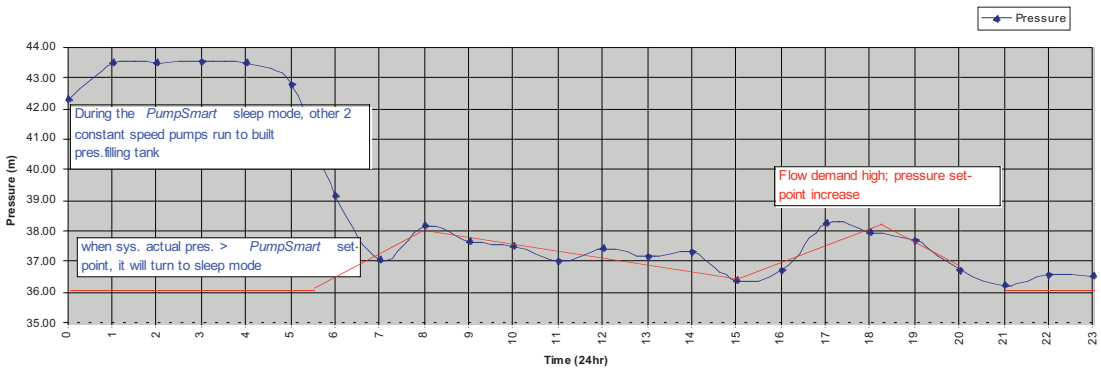

Figure 3. Pressure readings after introducing new system.

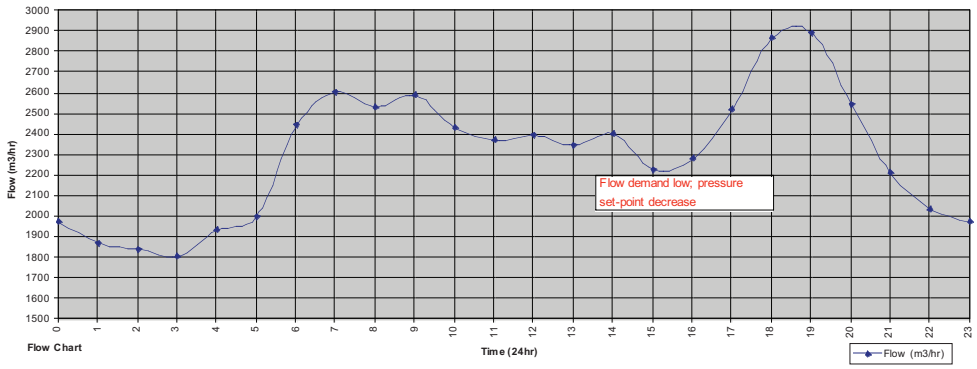

Figure 4. After the new system was introduced: During high peaks, the pressure output is automatically manipulated by flow demand from FT-signal regulation to satisfy customers by compensating friction losses in the piping system, thus saving more energy by decrease process set-point during low peaks.

By utilizing the multi-variable control function embedded within the drives, the SWB team was able to use both flow and pressure signals to establish a set point that optimized system efficiency through a lead-lag pumping operation on the Tag 5 and 6 pumps in the plant.

The VFDs maintain a pressure set point based upon a pressure transmitter signal and a flow set point based on a flow meter signal. Because these VFDs utilize direct torque control, instead of a scalar speed control variable such as volts/hertz, they have more precise speed control, more responsiveness and accurate control to the set point.

The lead-lag operation starts with the lead drive/pump initially regulating to the setpoint. If this drive/pump is unable to meet the setpoint conditions, it automatically starts the second drive/pump. The lead drive/pump continues at maximum speed while the lagging drive regulates speed to meet the setpoint.

In each case, the last drive/pump that is started will regulate to the setpoint. When demand drops, the system will destage the drive/pump that is no longer required to meet the setpoint.

This lead-lag switching serves to maintain uniform wear between the two pumps and has enabled the team to realize energy saving benefits up to 70 percent as a result of the automatic demand regulating system.

The VFDs contain embedded algorithms that monitor pump health and provide protection from process upsets – keys to reducing maintenance costs and improving system reliability.

The intelligent drive/pumps have been seamlessly integrated into the plant process control system architecture. Their system logic detects main pipe breakage and control, saves water and energy, improves the working environment by reducing noise and enhancing safety, improves utility metrics, reduces energy consumption, and enhances controllability.

The pumps and systems were commissioned in August in a ceremony which was attended by Sibu Water Board members, officials, consultants, contractors, and other end-users.

From the initial energy savings created by using these drive/pumps, the SWB team is now considering additional units. Each drive/pump has shown a savings of 1,700 euros in one month of operation, and customers in rural areas and the city have abundant water supply even during peak periods.

P&S

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