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Well-conceived Energy Action Plans Can Mean Significant Savings in Cost and Energy Use

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Energy Action Plans are critical tools for water and wastewater treatment plants seeking to successfully optimize performance while controlling costs and maintaining production throughout their systems. A well-conceived Energy Action Plan – followed by careful analysis and process improvements – can result in significant cost and energy savings.

Energy Action Plans typically begin with an on-site visit to facilities to identify and analyze the water system's major processes. That information is supplemented by discussions with key plant staff members. Historical utility costs and energy consumption provides a framework for identifying potential cost-saving recommendations.

Ultimately, cost- and energy-savings recommendations are made by matching a plant's utility profile with technologies and process improvement opportunities from energy, utility and automation systems that have been successfully applied in industrial environments. Industrially accepted engineering and statistical techniques are used to analyze the available data. Savings estimates are the result of historical billing analysis, manufacturer equipment performance data, and modified bin analysis.

Following are several findings from an Energy Action Plan prepared by the Schneider Electric Water/Wastewater Competency Center, located in Nashville, TN, for a municipal water system of a major Midwestern city serving more than one million people. Findings and recommendations resulting from this investigation are typical of plants of this size. In this particular case, a number of potential projects were proposed that could be implemented within a reasonable payback period to reduce utility costs.

This facility's major production processes were identified as screening, pre-oxidation, mixing, chemical coagulation, flocculation, sedimentation, filtration, disinfection, and pumping. The research conducted for this action plan can provide the basis for modeling the energy use of other major water systems.

Five major energy and utility project opportunities were identified in the energy survey process:

- **Production Process Scheduling**. This opportunity involves optimizing backwash processes at primary plants to avoid peak electric utility demand charges. Primary purification plants use sedimentation and filtration to remove suspended material from the water supply. This filter system required 400 HP of pump motors during the backwash and refilling process. The project recommendation involves the installation of an automation and control system to monitor the parameters used to initiate backwash. The new system would have the capability of forecasting those parameters so that backwashes could be initiated prematurely, if necessary, to avoid peak utility demand periods. The annual electric savings potential in this case is $42,900, determined by the utility rate structure and the plant's peak electrical demand.

- **Pump System Optimization**. To increase pumping efficiencies, Schneider Electric recommended a system that would automatically assist operators to control selected devices and provide system capacity requirements with the least electrical input. The system, which included comprehensive water demand profiling, would output for any condition, the optimum combination of pumps to operate. The annual electric savings potential for this system is significant, $35,600, since a relatively small percentage of the 45,000 HP of connected pump load would result in substantial cost reduction.

- **Adjustable Speed Drives**. By using adjustable speed drive control to replace discharge valve control of system pressures and flows, the pumps will be speed-controlled to their desired operating point. Adjustable speed drives can be used to maintain constant static pressure in the piping system or maintain system flow output by varying the speed of pump rather than throttling a discharge control valve. The high service pumps, generally 700 to 1,250 HP, would require custom-engineered drives. The booster pumps, ranging up to 300 HP, would use commercially available drives. Those booster pumps operate over a broad range, making them particularly attractive for adjustable speed control. The savings potential for using adjustable speed drives is $520,900 per year in electric cost reduction.

- **Diesel Driven Pumping**. It was also recommended that the plant use diesel-driven pumps, already available as back-up to electrically driven pumps, during periods of peak electrical demand to reduce electrical costs. The project required installing monitoring and control systems to monitor critical parameters and remotely start and stop the diesel driven pumps. The parameters include tank levels, and oil temperatures and pressures that would permit remote dispatch, operation, monitoring, and control. The annual electric savings potential, $36,060, is based on the utility rate structure and the demand profile of the facility.

- **Onsite Generation**. To use the on-site emergency generators for electric peak shaving, the recommendation was made to install monitoring and control hardware to monitor critical parameters and remotely start and stop the generators. Currently, the generators are equipped for parallel operation with the utility, but without the hardware to allow for reliable remote operation. The savings potential, based on the utility rate structure and demand profile, is $46,520 per year. Since some generators are natural gas driven, there is an added benefit of flexible fuel sources.

The Schneider Electric Water/Wastewater Competency Center identified $682,000 in potential annual savings, an estimated 17 percent reduction in total electric costs. Of course, actual savings can depend on many factors, including variations in energy costs, weather conditions, and operation and maintenance practices at individual facilities. However, the study demonstrates the significant energy savings a water facility can realize through careful analysis and process improvements.

Energy, utility and automation Energy Action Plans are the keys to optimizing performance and controlling costs, while maintaining production throughout the system. Through these services, water and wastewater treatment plants are able to produce a facility energy profile, identify energy consumers, measure their contribution to peak demand, and identify no-cost/low-cost methods for energy savings. The Energy Action Plan represents a critical step toward ensuring that plants are performing at maximum efficiency and controlling one of their largest costs.

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