Multi-source Pumping Optimization

Product Capabilities Brief

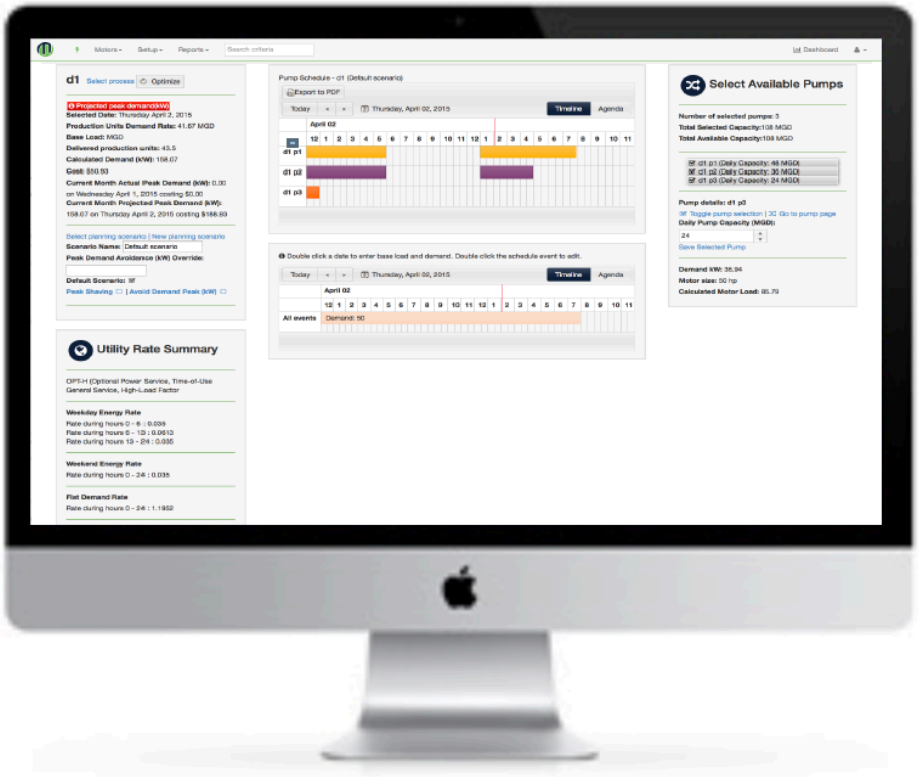
Asset Sustainability @ Work LLC; March '15

Motors@Work™ Patent Pending Multi-source Pumping Optimization is an integral capability to Motors@Work™ developed specifically for the Water and Wastewater Industry Sector. Motors@Work™ will enable the utility to know exactly where their pumping system energy is going and, more importantly, where it should be going. Pumping system optimization intelligence will meet the Operator's water demands while saving energy expense—all of which goes straight to the bottom line.

Introduction

It wasn't long ago that water/wastewater utilities believed that energy efficiency was simply a cost of doing business. The cost of energy was embedded into the price of the product or service and passed along to the customer. Today, however, faced with constrained revenues combined with increasing costs, managers are being forced to take a hard look at ways to either increase revenues or reduce expenses. As you can imagine, increasing rates or reducing jobs are not very popular alternatives. However, one area that can certainly help the realities of this economic outlook is the potential expense reduction in energy consumption, generally a water/wastewater facility's second highest expense.

Water/wastewater is an energy-intensive operation. There are in excess of 75,000 water and wastewater systems in the United States alone, estimated to consume well over 150 billion kilowatt-hours (kWh) a year, approximately 12% of the total electricity consumed in the non-residential, commercial and industrial sectors. And if consumption growth is in line with overall energy projections, this will increase by 29% by 2040 (U.S. Energy Information Administration), further adding to the economic challenges water/wastewater providers face today.



How energy is used by water providers... and how they can use less

The majority of water processing and distribution energy consumption is by motors and motor-driven systems related to pumping. Given that over 80% of the electricity used by water systems is from pumping, most of the energy reduction gains can be realized through operating the water pumping systems more efficiently. These efficiencies are gained not only from a design and asset life-cycle management perspective, but by operating the right (most efficient available) component pumping system(s), at the right time, for the right duration, to meet operational requirements at the least cost.

To ensure availability for a specific process, most water operations have built-in pumping system redundancy to satisfy operational availability and capacity requirements. Each system supporting a specific process may be common in design purpose; however, they are typically unique due to disparate operating efficiency. Pumping system efficiency can vary greatly depending on the age, design, and operation and maintenance of the system over time. Couple this with the fact that the cost to operate a pumping system is dependent on time-of-use electricity rates (peak rates can vary by more than 500% from normal and off peak rates), systems availability, and varying demand, it's evident that managing multi-source pumping systems operations for optimum performance at the least energy cost is a complex operational problem.

Facts & Figures

Water / Wastewater Energy Profile

- Account for an estimated 150 billion kWh of U.S. electricity demand; approximately 12% of C&I energy consumption
- Over $17 billion a year on energy to pump, treat, collect, deliver and clean water,
- Energy costs can be over 40% of a municipality total energy bill and over 65% of a process facility O&M expense,
- Loads expected to increase by 20% in next 15 years due to increased populations and more stringent regulations,
- Energy efficiency investments often have outstanding rates of return and can reduce cost by 10%, 25% or more.

Drinking Water Utility

- There are over 60,000 community drinking water systems the U.S.
- Majority of Energy Use: pumping.
- Energy use affected by: water source, quality, storage, elevation, distance, age, and process.
- Major processes: production, treatment and distribution.

Wastewater Utility

- There are over 15,000 wastewater systems, including 6,000 Publicly Owned Treatment Works (POTWs) in the U.S.
- Majority of Energy Use: treatment process (aeration) and pumping.
- Energy use affected by: population, influent loading, effluent quality, process type, size, and age.
- Major processes: collection systems (sewers and pumping stations), wastewater treatment (primary, secondary, and/or tertiary), bio-solids processing, disposal, or re-use

Motors@Work ™ Opportunity

- Lower energy cost
- Increase pumping operating efficiency
- Systematically normalize Utility Provider generating capacity

The following intelligence is required to optimize pumping operation:

- Pumping system(s) energy efficiency
- Optimum pumping system(s) operating configuration
- Optimum pump systems(s) operating strategies
- Potential cost savings
- Potential environmental impact
- Opportunities to shave peak load
- Opportunities to reduce demand charges
- Additional capacity requirements
- Excess capacity requirements
- Non-conformance identification and communication
- Out-of-service capacity needing expedited
- Identification of potential maintenance and system capital improvement opportunities
- Validation of efficiency countermeasures

Without the requisite intelligence, the probability of operating a pumping operation at the least cost is difficult at best, and more than likely, not sustainable. Access to the intelligence holds significant potential to reduce energy costs. Some estimates put savings equal to, if not exceeding, system efficiency gains.

Framework for Smart Pumping Solutions

Optimal pumping system performance at the least energy cost is predicated on the convergence of energy, asset management, and operations. Any approach must factor in process definition (what specific pumping systems comprise what unique processes), system(s) efficiency, system(s) availability, system(s) capacity, time-of-use energy and demand rates, the demand required, and operating strategy (base load v. variable load, peak shaving).

Of equal importance is the capability to assess, based on the most current operating and performance data available, pumping system energy performance, and non-optimal operating anomalies, and notifying the appropriate stakeholder at the right time, at the right place, and with the right information to address potential opportunities and assess operating changes once they are made.

The Utility Operator's approach should be to systematically achieve the best outcome (i.e., minimum costs) through the optimization of pumping system demand, capacity and costs. Ultimately, the Operator's framework, enabled by Motors@Work™ Patent Pending Multi-source Pumping Optimization will provide the intelligence needed to answer the following questions:

- Which pumping systems should be operating to meet operational demand?
- What is the optimal pumping strategy and system operating configuration?
- How long should each pumping system operate per day?
- When should each pumping system operate per day?
- Are the pumping systems operating at the least possible cost?
- What is the cost per day to operate the pumping systems?
- Is additional capacity required to meet demand?
- What is the environmental impact of the pumping operation and the management controls required to keep the program sustainable?

Multi-source Pumping Optimization Patent Pending

There are several considerations must take into account when adopting a pumping system(s) optimization approach, including:

1. The pumping system(s) configurations, design basis, and availability need to be defined and systematically kept current.
2. The pumping system(s) efficiency needs to be systematically determined and kept current.
3. Applicable electricity provider time-of-use rate schedules need to be mapped to the unique pumping system(s).
4. System demand (capacity requirements) needs to be allocated to the pumping system(s) and ad-hoc adjustments enabled.
5. The intelligence and controls need to organizationally align accountability and responsibility.

Conclusion

Motors@Work™ Patent Pending Multi-source Pumping Optimization provides the Water and Wastewater Operator the intelligence to run the right pumping systems at the right time in the most efficient and cost effective manner to meet the operational demands. Motors@Work™ Patent Pending Multi-source Pumping Optimization will significantly reduce energy expense, improve operating efficiency, and systematically help to normalize the Electric Utility Provider's generating load.

Motors@Work™ Patent Pending Multi-source Pumping Optimization Features:

- Pumping system and system components (motor, hydraulics, and piping) energy efficiency and loss determination
- Benchmarking / comparison of actual System performance vs. Best Practices
- T-O-U Utility rate schedules for season, time of day, demand charge and power factor
- 47,205 pre-defined Electric Utility Rate Schedules from 4,643 EIA-recognized Utilities
- Custom Utility Rate schedules
- Peak Demand expense avoidance
- Multi-source Pumping process definition
- Fixed and variable speed pumping systems
- Multi-tier linear pumping system optimization
- Pumping system optimization by month, day, and hrs. within a day
- Energy expense reduction strategies enablement
- Operational strategies enablement
- What-if scenarios
- Retained scenarios
- Capacity demand rates; Daily, time-of-day, and base capacity requirements
- Operating cost for operating configuration scenario
- Analytics, Reporting, and Non-conformity Notifications
- Graphical and calendar daily pumping system schedules
- Leverages Motors@Work™ My Motors and My Pumps capabilities
- Leverages and preserves the Operator's technology investments.

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