

A Changing World

The benefits that the best of today's advanced automation systems can bring to water and wastewater utilities



Introduction

Water and wastewater utilities are facing an increasingly diverse set of operational challenges. Population growth, source water management, increasing regulations, overflow violations, consent order compliance and aging infrastructure – and now the specter of cybersecurity threats - are all straining the ability of water and wastewater utilities to serve their communities.

Understandably, few authorities are positioned to handle these issues, especially when complicated by tax base reductions, the retirement of experienced industry managers, engineers and operators, and a host of other factors. Municipal water and wastewater utilities across the country – big and small – need help.

One of the most often overlooked sources of relief can be found in the many advances which have been made in the development of automation solutions.

But We Already Have a Control System!

Whether you call them control systems, SCADA, DCS or PLCs, most utilities now utilize automation to some degree. However, few take advantage of all the features and benefits that today's advanced automation solutions can provide – and many don't grasp the importance of what they already have.

The investment that most authorities have already made in their plant control and SCADA systems can often serve as the foundation on which an advanced automation system can be built.

Patchwork Control Systems and Islands of Automation

It's been a common practice among many water and wastewater utilities to install control systems without much in the way of overall strategy or planning. To make matters worse, as time goes by, control system components are often replaced piecemeal as they become obsolete. This leaves many utilities with a patchwork of PLC subsystems – “islands of automation” – that don't easily communicate with each other. They not only become expensive to maintain, but also make expansion to meet population growth or changes to accommodate new treatment, conveyance or storage processes difficult.

Moreover, the patchwork of control components makes it very difficult to achieve a common, facility-wide database, a critical foundation for many of today's best advanced automation solutions. The absence of a unified, comprehensive database makes it difficult to implement many of the new, high-value applications which are now available. For most utilities, the data is there, it's just not easily accessible to the higher-level applications.

The Benefits of Advanced Automation Solutions

Only a few years ago, automation meant basic control and monitoring. Advanced automation solutions have now enabled forward-thinking water and wastewater authorities to improve their operations significantly by addressing some of the greatest challenges facing the industry. Some of the new technologies available include:

Process Optimization

Optimization technologies allow authorities to find the most efficient operating parameters for a particular process. A case in point might be a scenario involving a large pumping station which consists of three pumps, each with variable frequency drives (VFDs). Pumping stations such as these can be huge energy consumers.

A question often arises as to how to allocate these pumps to serve a given flow demand. Should all three pumps be operated at 25% capacity? Should one pump be run at high capacity and the other two idled? Some other combination of pumps and capabilities? What if one of the pumps has a degraded seal, failing bearings or some other problem?

Advanced process optimization applications can take all of these factors, and many more, into account and help determine the best, most energy-efficient operating point automatically, while protecting valuable assets.

Machinery Health and Predictive Diagnostics

Water and wastewater utilities operate some large and expensive machinery including pumps, centrifuges, mechanical separation and filtration equipment, and a host of other assets. With advanced, predictive machinery health solutions, it's possible to better monitor the health of large rotating assets and predict problems before they occur. This simple shift from emergency, reactive repairs to preventative diagnostics and maintenance can save money, reduce unplanned service outages, protect critical assets and improve the safety of both workers and the public.

Cybersecurity

The fear of cybersecurity vulnerabilities, whether through malicious attacks, viruses or simply poor software maintenance, is a constant threat in nearly every walk of life. When the threat compromises critical infrastructure such as water and wastewater utilities, safety, health, financial resources and the ability to provide the most essential of community services are on the line.

The best of today's automation systems can provide the ability to help strengthen security. Features of these systems focus on countering threats and protecting system network integrity. Real-time antivirus protection guards workstations and servers against viruses and malware. Application control effectively mitigates malware threats. Device control secures and centralizes management of storage devices associated with Windows-based workstations and servers. An agent-based solution determines patch needs within workstations and servers. Tools are provided for backup and recovery.

Pump Efficiency Monitoring

Large pumps are the lifeblood of many water and wastewater utility operations and their operation accounts for a large portion of a utility's energy expense. However, pump efficiency often degrades over time due to seal or other problems. Poor pump efficiency increases energy use, reduces capacity and poses a hazard of catastrophic pump failure.

Automation solutions can now provide continuous, real-time monitoring of pump efficiency versus pump design parameters. This essentially provides continuous monitoring of how far the pump has diverged from its design curve.

Remote Visualization

Being responsible for water and wastewater utilities requires constant awareness. Many facilities operate 24/7. Many managers, engineers and supervisors would relish the idea of being able to stay in touch with their operations no matter where they may be, at any time of the day or night.

The best of automation systems can provide secure remote visualization of plant data to an authorized users' cell phone, tablet, or computer.

Emergency Backup Offsite Control Centers

Since most facilities need to be able to operate 24/7, the prospect of having to shut down operations for any reason is almost unthinkable. Shutting a facility down to evacuate personnel due to weather emergencies, civil disturbances, wildfires or other problems needs to be avoided if possible.

Modern automation systems can provide the ability to maintain a secure, offsite, back-up control center which will allow for the continued operation of the facility in the event that an evacuation is ordered.

Simulation

Education can only take us so far, and on-the-job training is limited. For example, teaching operators how to handle highly dangerous situations is risky – you wouldn't want to turn the controls over to a rookie if people could be hurt or equipment damaged by a mistake.

Simulators provide a great way to extend training into a safe environment, where making a mistake can't cause any damage. In fact, simulators provide a great way to train operators regardless of experience levels, especially in how to handle infrequent but dangerous situations. However, simulators of the past were expensive and difficult to maintain. They were usually reserved to training pilots and nuclear power plant operators.

Today's automation systems, at least the best of them, can be utilized as the foundation for simulators which mirror the actual control system in a very cost effective, easy-to-maintain manner. These simulators bring the added advantage of allowing operators to train on the exact equipment that they will be using to control the plant.

Getting from Here to There – The Importance of Automation Master Planning

Since integrated, unified plant controls and SCADA systems provide the enabling foundation for many advanced technologies, it's important to plan for unification so that the resulting system gives operators and engineers access to all plant data.

An integrated district-wide approach to automation allows for monitoring and control of all elements of water and wastewater operations – treatment plants, CSO basins, pump stations, water distribution and wastewater collection, weather monitoring stations, etc. This is where the investment in automation really pays off.

So how can unification be accomplished if most utilities already have some degree of automation? Few utilities can afford to implement a complete replacement of their existing control subsystems. It is feasible, however, to develop a master automation plan which will result in a best-in-class automation system over time, and the payoffs can begin almost immediately.

By clearly identifying the features needed, subsystems can be replaced over time with systems that will enable a unified database. In turn, this will act as the enabler to the advanced applications which can reduce costs, protect assets, reduce energy costs and strengthen security.

Conclusion

It's easy to see that today's automation systems can provide tremendous value compared to the systems of just a few years ago. The good news is that the investment that an authority has already made in automation can be leveraged to build the advanced automation solution needed to implement the high-value applications that can really make a difference.

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