Life Is On | Schneider Electric

Realigning Water Industry Assets in Digitally-Enhanced Operations

How digital transformation is blending information and operational technology for asset performance improvements that will reduce costs, optimize efficiency, and improve conservation

Executive summary

As water is increasingly being recognized as a high-value commodity, aging assets present a major threat to organizations that treat and deliver it. Improving asset performance is one of the most effective strategies a water and wastewater plant or network can take to reduce costs and protect quality. Digital transformation enables asset performance management by automating and integrating information technology (IT) and operational technology (OT). Collecting operational data from connected assets such as pumps and sharing it with real-time decision support applications – in the cloud or on premises – is how digitization improves asset performance.

This paper presents a three-part asset performance improvement program to align water and wastewater plant and network assets for a new generation of cost-efficient, high quality water processing and distribution.

The need for change

"The water industry has reached a turning point. Utilities are finally recognizing the power in digitizing operations and increasing economies of scale to extend asset life and address legacy funding issues.

As the industry focuses more on sustainability, value and innovation, a new water economy appears to be emerging: Utilities are embracing data and infrastructure in new ways to maximize efficiencies…"

Black & Veatch Report on the Water Industry, 2018[1]

Water and wastewater operations around the globe stand to gain significantly from the digital transformation of global industry. This opportunity comes at a time when water is recognized as a limited, high-value resource. The United Nations projects that if current water usage trends continue, by 2030 the world will have only 60 percent of the water it needs. This pending scarcity compounds pressures already mounting in the industry:

- Aging infrastructures contribute to water losses and inefficiencies
- Cash-strapped municipalities demand greater fiscal accountability to reduce the cost of supplying, treating and conserving water
- Skilled personnel age out of the workforce faster than the replacement pool is growing
- Climate extremes challenge water treatment, supply, wastewater, and stormwater management capabilities
- Regulations on energy, water quality, standard of service, and emissions are increasingly stringent
- Threat of cyberattack looms

While the industry attacks such challenges on many fronts — including water conservation and demand management — improving asset performance is a logical first place to start. It can help counter the effects of aging infrastructure, reduce total cost of ownership, empower maintenance teams to do more with less, and ultimately optimize the performance of each asset. Indeed, asset management has become a top concern among a growing number of water operations.

Water industry respondents citing "maintaining or expanding asset life" as their most significant sustainability issue:

42.7%[1]

Water industry respondents "very interested" or "interested" in implementing asset management programs:

82.5%[1]

Water industry respondents "very interested" or "interested" in real-time control or big data system analytics:

69.6%[1]

Do these numbers match your experience?

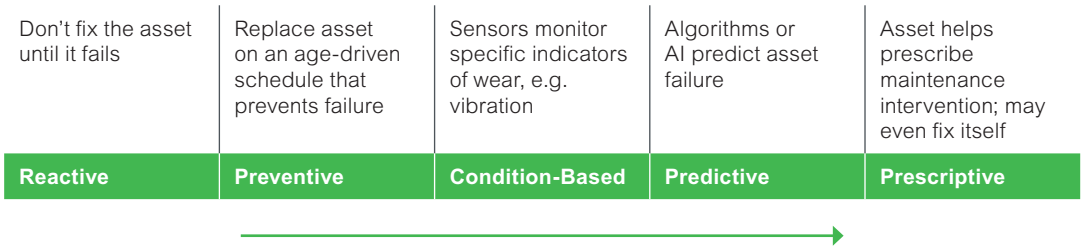
[1] *2018 Strategic Directions Water Report,* Black & Veatch; survey of 517 water industry operations, engineering and executives

Asset performance improvement in a digital age

As recognition of the value of asset management grows, the practice is steadily maturing, advancing from reactive run-to-failure approaches to predictive and prescriptive strategies in which increasingly intelligent assets all but manage themselves.

ARC Advisory Group reports that moving up the scale from preventive and condition-based approaches to predictive and prescriptive strategies has enabled users to cut the cost of maintenance labor and MRO (Maintenance, repair and operations) materials by 50 percent.[2] ARC analysts also estimate that on average, industrial operations lose about 5 percent of their operating budgets to downtime, which can be reduced to zero through more sophisticated asset management techniques. Eliminating downtime can ripple benefits well beyond maintenance productivity, impacting service delivery, product quality cost and many other factors.

Figure 1
Maintenance Maturity.



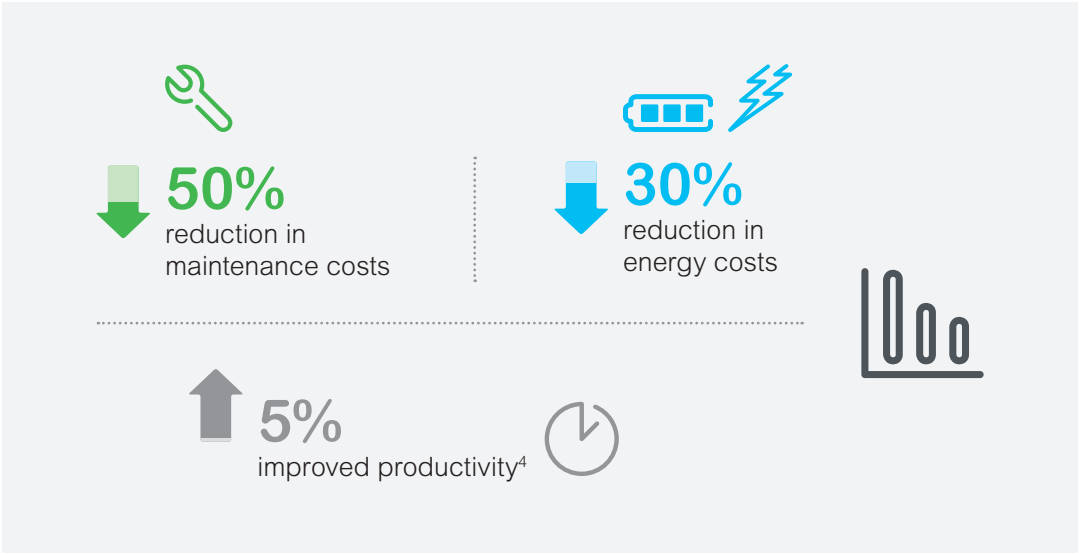
The increase in maintenance maturity, from a break/fix approach to a critical bottom-line component of operational success, sets the stage for the transition from baseline asset management — which seeks to ensure asset availability — to more strategic optimization of asset performance. Asset optimization, according to ARC, is the result of *"more information sharing and application integration among operations and maintenance to provide a comprehensive view of production, asset performance, and product quality."*[3]

Water and wastewater infrastructure operators have always had much to gain by sharing information and integrating applications, but it has been primarily the early adopters or better-funded water operations that have been able to see significant return on their investment. Today, however, new capabilities to collect, analyze and share process data digitally bring the benefits of asset performance improvement well within the reach of even the smallest operations.

[2] ARC Advisory Group – *Reducing Unplanned Downtime and Helping Future-proof Automation System Assets*

[3] ARC Advisory Group – *Leading Industrial Organizations improve Asset Management with Industrial IIoT. October 2016*

Early adopters in the industry are applying mature asset performance improvement strategies[3] already to attain results such as:



Asset performance improvement program architecture and objectives

Achieving asset performance management in a cost effective way involves augmenting traditional client/server information architectures with technologies such as IIoT gateways, edge analytics, and cloud computing, which are more open and amenable to digital control. It involves bringing information technology (IT) and operational technology (OT) together securely in ways not previously feasible. The EcoStruxure architecture provides a platform that can guide the management, integration, evolution, and protection of your digital infrastructure as you transition to the benefits of asset performance improvement. (Figure 2)

* The Schneider Electric industrial software business and AVEVA have merged to trade as AVEVA Group plc, a UK listed company. The Schneider Electric and Life is On trademarks are owned by Schneider Electric and are being licensed to AVEVA by Schneider Electric.

Figure 2
The EcoStruxure architecture provides a framework for the organization, integration and protection of water and wastewater assets.

[4]The average plant loses 5% of production capacity to downtime. With prescriptive, high level of maintenance maturity this can be significantly reduced according to ARC.

The EcoStruxure architecture for water & wastewater models the flow of information from smart field devices at the base layer, through gateways and controllers at the middle and edge layers, into IT applications and analytical services for ultimate presentation to decision makers. Partitioning your digital infrastructure in this way provides an orderly framework for introducing digital technologies to improve asset performance. It will help you achieve the following three objectives:

Three Steps to Asset Performance Improvement

Secure baseline reliability of OT assets

Enhance baseline reliability through advanced IT and digital applications

Optimize asset performance strategically, enhancing digital tools and techniques through further integration with multiple assets and all relevant plant operating data

Attention to these objectives: securing baseline reliability; enhancing it through advanced IT and digital applications and optimizing performance, can bring you benefits allowing you to:

- Optimize asset availability and utilization
- Manage aging infrastructure
- Reduce CapEx
- Control OpEx
- Manage energy costs
- Reinforce physical and cyber security
- Empower your workforce
- Comply with environmental and safety regulations

Program Objective I: Securing baseline reliability

Much of the action for securing baseline reliability takes place at the connected devices level of the architecture. It entails application of best practices defined in emerging standards such as ISO 14414 for pump system energy management and ISO 55000 for general asset management.

Digitization at this level involves taking fuller advantage of the digital diagnostic and monitoring techniques that are already available in many drives, motors, actuator, process instrumentations and other devices. These can extend preventive strategies beyond the fewer than 20 percent of assets to which they currently apply and help rationalize condition monitoring alarms.[5]

Traditional preventive maintenance and condition monitoring, however, tends to focus on individual, isolated assets. As assets get more connected and have more onboard intelligence, the possibilities for enhancing reliability through interaction among analytical applications grows considerably.

Program Objective II: Achieving maintenance excellence through IT/OT integration

While digitization of OT has benefits in and of itself, sharing the data with advanced, water-savvy applications can take cost control and efficiency to a new level. The advent of pervasive communications, cloud storage and mobility now bring the possibility of applying advanced IT tools to reach new levels of reliability and availability. Information from anywhere can now be shared cost-effectively with applications and users anywhere.

[5]ARC Advisory Group – *Leading Industrial Organizations improve Asset Management with Industrial IoT. October 2016*

Capitalizing on intelligent assets

Smart variable speed drives are a good example of what digitization can accomplish. They record and log energy use and display energy consumption trends on an hourly, daily, weekly, or monthly basis. They can diagnose when a gearbox is exceeding a preset torque level or when a pump is operating outside parameters. They can detect instantly if, for example, pump efficiency drops and can trigger notifications. The drives can also be integrated with pressure, flow, and level control to compensate for flow losses.

Making the most of real-time and historical data

Helping you interpret such data are applications such as EcoStruxure Pumping Performance Advisor. Pumping is one of the largest consumers of industrial energy, so optimizing it can reduce costs and improve overall operations dramatically.

EcoStruxure Pumping Performance Advisor coordinates predictive and prescriptive maintenance-based on data produced by smart drives; pressure, temperature, and flow sensing instrumentation; or power monitoring devices. (Figure 3) From these devices the IT application receives data on energy, costs, maintenance, and other key performance indicators (KPIs); runs algorithms that evaluate them against desired targets; and shares the analyses with other applications and decision makers via browsers, dashboards, or mobile devices — all of which help you keep pump stations and other assets running at peak performance.

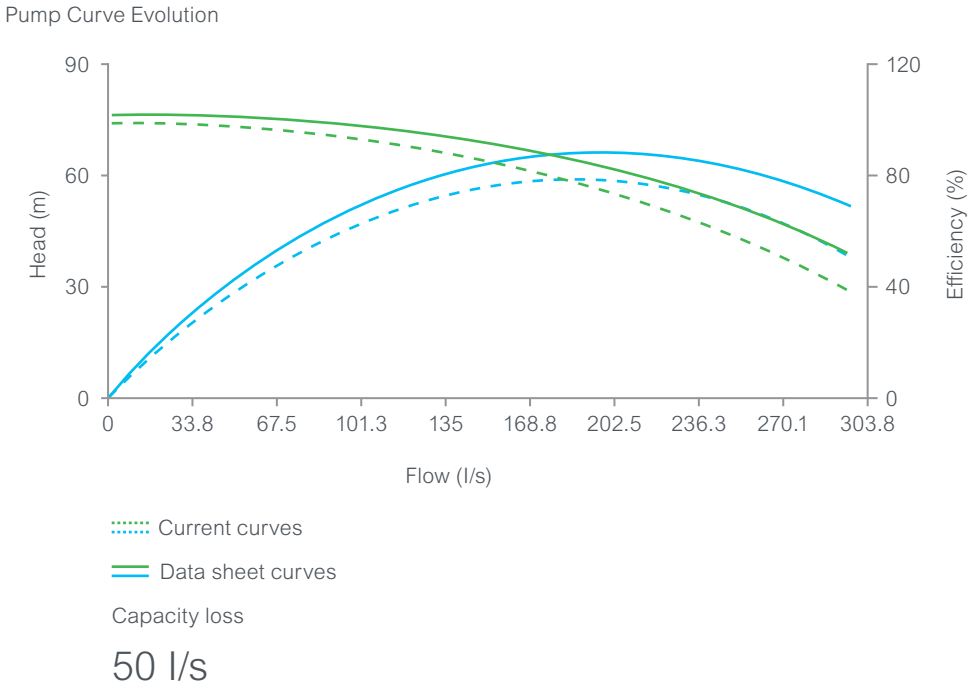


Figure 3

Pumping Performance Advisor software provides operators with a real-time comparison of the operating pump curve to the curve presented in the pump manufacturer's data sheet.

EcoStruxure Pumping Performance Advisor is just one example of a digital application that can improve water asset performance. We called it out here because pumps are such a critical component of water operations, and will address its use in subsequent guides in this series. Other digital applications available include engineering and planning applications, enterprise asset management, resource management, power management and augmented reality support for technicians.

Excellence at the edge

A digital application might receive data from smart drives via an edge gateway such as an IIoT edge box that connects to data on the cloud, on premises, or both. Edge controllers such as PLCs, PACs, RTUs or DCSs might also perform real-time calculations and buffer results to send to enterprise applications in the cloud. This local buffering enables cloud-based applications to factor in critical data they might never see otherwise.

The Black & Veatch researchers mentioned earlier in this paper found high interest in remote sensing among the industry professionals they surveyed. Remote sensing is a key enabler of asset management. Edge devices can receive operating data by digital radio links, and built-in data buffering then ensures data integrity. Digital radio links could simplify data delivery from smart products and edge controllers, collecting data from remote pumping stations and sending it to apps and analytics levels, enabling a more complete real-time picture of pumping station efficiency.

Security across the board

Critical to the cost-effectiveness of the EcoStruxure platform is simplifying plug-and-play deployment of field devices, edge controllers, and applications, which entails a commitment to using standard communications and interfaces. Minimizing any vulnerability that this might introduce, requires implementing technology certified secure at each layer of the architecture.

- At the connected product layer, for example, products are designed to IEC 6244 standards, certified to Achilles level 2 and adhere to a strict security development life cycles.
- At the edge layer, the platform uses advanced encryption key management, unified extensible firmware interface (UEFI) for Windows 10 applications, McAfee whitelisting, and secure transport layer security (TLS) connections to SCADA systems.
- And at the application layer the platform utilizes the secure Microsoft Azure cloud, secure authentication with communications for cloud, authenticated integrated database managment (IDMS), and requires compliance with ISO 2700 standards. All such protection is transparent to users.

Program Objective III: Optimize asset performance strategically, in context of all operations

While the first two legs of your asset performance improvement program will offer significant benefit in and of themselves, this greater control over asset reliability and availability will free you to put more attention on maximizing the production from each asset with optimal resource investment and without compromising safety or environmental conservation.

"We can produce much more efficiency by treating the whole business as a proper core system," said Michael Teller, Water & Wastewater Business Unit Managing Director. "Part of the solution is equipping operators with systems that alert when leaks or pipe bursts are imminent; the other part is training them to use it." Teller continued.

Understanding asset performance in the context of its impact on all assets is what moves maintenance beyond just securing reliability, to becoming a critical contributor to cost control and strategic management. Accessing and integrating data from a wide range of facility systems — such as power distribution, water demand forecasting, procurement, and quality — and analyzing it with productivity and software applications, will give you a more complete picture of output, flow volume, and energy consumption. This ensures meeting your objectives as you will be able to:

- Monitor asset performance against KPIs
- Adjusting for predictable surges in demand for water
- Maintain a safe and secure processing environment
- Reduce procurement and inventory costs by building in time to shop and negotiate
- Avoid unnecessary penalties, through real-time reporting capabilities
- Improve end-user satisfaction

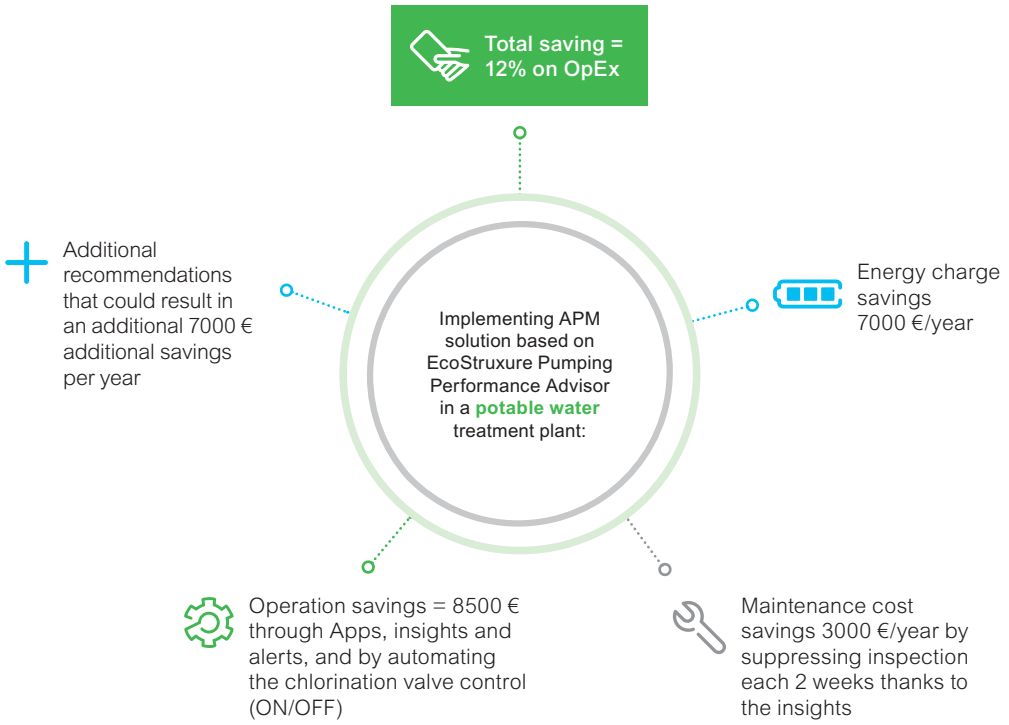
Of course getting such results drawing on information cloistered away in unconnected locations and multiple formats is all but impossible. The EcoStruxure architecture guides consolidation of diverse information so it can be shared consistently and cost-effectively across a variety of applications.

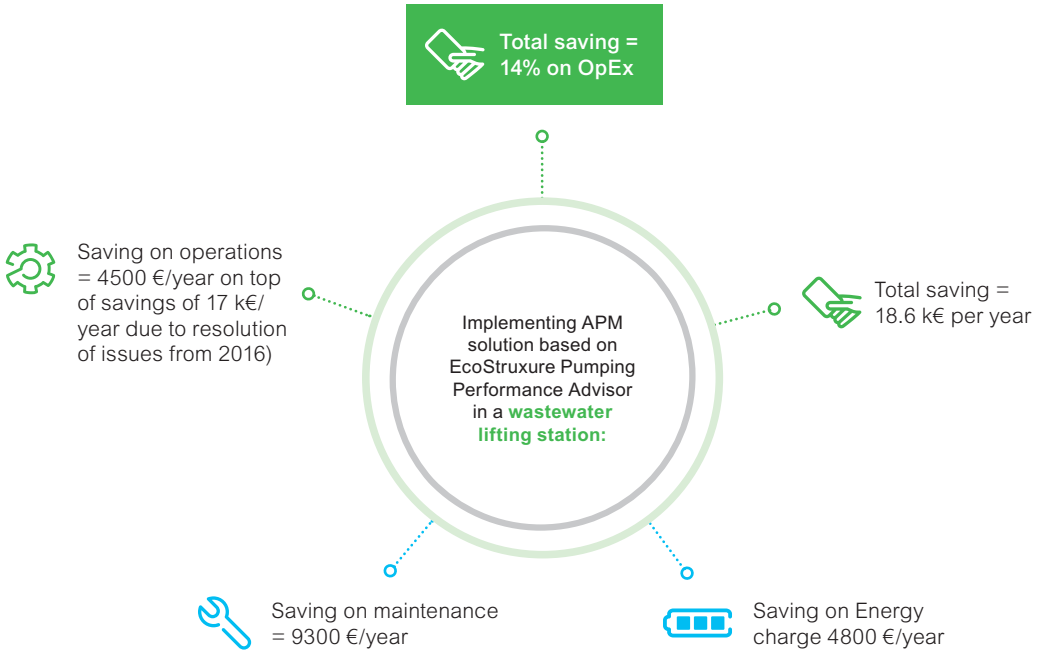
Getting Started in Asset Performance Improvement

Implementing a successful asset performance program requires a team with knowledge of the local operations supplemented by remote expertise informed by collected data and analytical tools. A project typically begins with clarification of management and operating objectives and an audit of existing assets to gather baseline data on your systems, operating and maintenance costs, P&IDs (process and instrumentation diagrams), annual operating time and recent history, all guided by the latest industry best practices and standards.

Evaluation of asset parameters and application of advanced tools leads to insight and recommendations for potential savings that you can achieve through reliability improvement initiatives. This usually entails use of connectivity tools, dashboards, and instrumentation, deployed within the EcoStruxure architecture. With this evaluation completed, the project continues by implementing advanced tools that lead to easy insight into the assets, while at the same time, recommendations for quick-wins can be implemented.

Whether you are working with internal resources, third party system integrators, or experts from the Schneider Electric water and wastewater service bureau, it is critical to monitor improvements against KPIs over a few months and tune operations for maximum reliability control. Setting a baseline that ensures maximum asset availability will give you a framework on which to focus asset performance optimization and achieve maximum utilization of your most strategic assets. Most of our clients who implement asset performance improvement programs begin seeing a return on investment within as few as three months.





If you would like to learn more about how to get started with implementing an asset performance improvement program and achieve results like those shown for your plant or network: We can arrange a call or visit to help you get started in asset performance management.

Request to be contacted.

Additional resources

- Link to asset performance landing page

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