

# Enabling sustainable reuse with real-time optimization

Digital optimization solutions are improving water treatment facility performance in real-time, supporting industries and municipalities in reducing their environmental footprint and carbon emissions and enhancing operational cost savings, according to Aude Giard from Veolia Water Technologies.

For companies that have a strong water agenda, sustainability is fundamental for long-term success and resilience. Industries such as municipal water and water resource recovery authorities, or those that have water efficiency as a key driver – rely on large volumes of water for processes. The food and beverage, pulp and paper, and even oil and gas sectors are shifting sustainability to the heart of their businesses. It is far more than an attractive add-on. Increasingly, sustainability is becoming a differentiator that is having profound impacts on businesses and operations.

Swiss bank UBS, for example, recently announced that the value of its sustainable investment portfolio increased by more than half last year. UBS lending to the energy and utilities sectors fell by some 40 percent over the same period.

## Increasing need to reuse water

The need to put sustainability front and center for water-heavy industries is increasingly being recognized by regulatory authorities, as well. Late last month the United States (US) Environmental Protection Agency (EPA) released a development to the National Water Reuse Action Plan (WRAP).

A coordinated effort across the water use sector to advance consideration of water reuse to ensure the security, sustainability, and resilience of water resources, WRAP identifies 37 actions, implementation milestones, and target completion dates across 11 strategic themes.

Similar measures to include sustainability at the core of water-using industries are also underway in Europe. Late last year, for example, the European Commission (EC) reached a provisional agreement on minimum requirements for water reuse in agriculture.

Among other measures, the new rules detail a set of minimum water

quality standards for the reuse of urban wastewater in agricultural irrigation. This will ensure that treated urban wastewater – which is already subject to the Urban Wastewater Treatment Directive – is suitable for use in agriculture.

The EC notes that, at present, about 1 billion cubic meters (m<sup>3</sup>) of treated urban wastewater is reused annually. However, that represents only about 2.4 percent of treated urban wastewater effluents and less than 0.5 percent of annual European Union (EU) freshwater withdrawals. They argue that the EU potential is far higher, estimated at some six times the current volume. Cyprus already reuses more than 90 percent of its wastewater, clearly indicating a significant potential for improvement.

Clean water and sanitation – one of the 17 Sustainable Development Goals listed by the United Nations – demand improved efficiency in its use and reuse. In response, today many diverse companies are turning to digital solutions to help them meet their sustainability goals.

## Adopting digital solutions to improve business performance

Alongside the core sustainability business imperative, operators of water and water resource recovery facilities across a range of sectors face an array of additional commercial challenges. These include the need to reduce operational costs and capital expenditures, while increasing efficiency, reducing maintenance and downtime, as well as minimizing non-compliance events and regulatory interventions.

Many industries are now adopting a new generation of digital tools. These tools enable better monitoring of equipment and process performance and ensure the feasibility of real-time optimization to reduce energy demand, chemical usage, and the environmental impacts of water treatment processes.

According to a recent analysis from Frost & Sullivan (a US market research and analysis consulting firm), water and wastewater utilities are actively exploring Industrial Internet of Things (IIoT) solutions, and the global smart water network

market is expected to be worth some US\$22.2 billion in 2020 alone. Meanwhile, smarter, more advanced asset management strategies are expected to save water utilities of the order of \$42 billion in capital expenditures by 2027, according to Bluefield Research (an analysis firm based in Massachusetts, US).

## Working with utilities to develop solutions

So, what do these growing markets mean for facility owners and operators?

By using specific live data from water resource recovery facilities, real-time optimization algorithms automatically optimize the facility's performance (relative to variations in the incoming load) while reducing costs and enhancing the biological and hydraulic capacity of the facilities.

One example is Veolia Water Technologies' cloud-based AQUAVISTA™ – a suite of digital intelligent software solutions that provide these functions and allow municipalities as well as industries to boost their performance.



The Danish utility BlueKolding A/S equipped the Agtrup water resource recovery facility with the AQUAVISTA solution, which resulted in lower total nitrogen, reduction in chemical precipitant, and 70-percent reduction in catchment overflow. Photo by Veolia Water Technologies



With this approach, the full orchestra of all the facility's equipment can play tunelessly together. This corresponds to facility-wide and real-time optimization.

Left: Overview of the Nosedo water resource recovery facility, which services the city of Milan, Italy. Photo by Veolia Water Technologies

## Nosedo facility achieves 60-70 reuse for agriculture in Italy

In 2019, Italian public utility company Metropolitana Milanese SpA adopted AQUAVISTA at its Nosedo water resource recovery facility – the main water resource recovery facility for the industrial city of Milan, which began operations in 2004 with full nitrification and denitrification. AQUAVISTA is used to optimize energy usage and chemical consumption, as well as increase hydraulic capacity to handle higher peak flows during rain events. With 60-70 percent reuse of the final effluent for agriculture, Nosedo is the largest recovery facility in Europe.

"Our challenge is to guarantee, every time, the best condition for reusing water," Andrea Aliscioni, chief operating officer for the Milan Water Service, Metropolitana Milanese SpA., explained. "We need – even in a high hydraulic-stress [event] – to constantly guarantee the performance of our facility. Digital innovation can do

this in a simple way."

Following commissioning of AQUAVISTA, Nosedo targets operation costs savings of US\$450,000 per year, with significant energy savings found in aeration, mixing, return of activated sludge, grit chamber aeration, and nitrate recirculation activities. In terms of chemical usage, there is a 40- to 60-percent reduction in the use of precipitation chemicals like ferric chloride, while sludge reduction is at around 65 to 90 metric tons per year.

"Digital solutions can help us to link the data from our wastewater network and sewage network to operational instruction of the final plant. Using these two kinds of data, and by digital interaction between them, we can reduce the operational cost of the plant and we can reduce the tariff for the citizens of Milan," explained Aliscioni. "The future of water, in this case of wastewater, is recovery."

Features of an AQUAVISTA™ Plant have been developed in conjunction with clients since 1990. They include complex algorithms that act holistically across the entire wastewater cycle, according to strategies and settings defined by the operating staff. For each facility, specific parameters are paired with actual performance data and are sent up to the cloud, computed in the algorithm, and then retrieved by the facility again to be executed automatically at individual

physical items.

Operators, process engineers, and managers are able to choose from a variety of features that target their specific needs. Data may be retrieved every two minutes, while set points can be recalculated and reestablished as physical parameters for any optimization set point.

This could translate to operating aeration blowers less frequently, performing reduced pumping operations, and dosing fewer chemicals. All of these benefits lead to

minimization of operations costs while still being compliant with regulatory effluent standards – which is always first priority. With this approach, the full orchestra of all the facility's equipment can play tunelessly together. This corresponds to facility-wide and real-time optimization.

## Keeping BlueKolding green

An example of successful use of digital optimization tooling comes from BlueKolding A/S, formerly Kolding Wastewater. A utility company that covers the entire Denmark seaport municipality of Kolding, BlueKolding treats the wastewater from the 100,000 residents. Of the total water treated, some 12 million m<sup>3</sup> per day (8.7 million gallons per day [MGD]) is processed at the Agtrup central water resource recovery facility annually.

Looking to optimize the entire sewage system and deliver capacity expansion through software solutions, the company began adopting the AQUAVISTA facility solution in 2007. Initially, the aim was to ensure operational savings while remaining compliant and improving effluent quality. The result was 25-percent lower total nitrogen (total-N) and a 45-percent reduction in chemical precipitant, as well as a catchment overflow reduction of more than 70-percent.

Subsequently, the 2011 introduction of an integrated control system at Agtrup ensured an 80-percent increase in peak hydraulic capacity at the facility. This reduced the costs of a planned basin extension by 22 percent and simultaneously cut the number of overflow events from an estimated 35 a year to less than 10.

BlueKolding had been required to reduce combined sewer overflow (CSO) volumes discharged to the Kolding Fjord bay to half of pre-2012, and to reduce the frequency of CSO occurrence by two thirds. Its initial solution had planned the development of an 8,000 m<sup>3</sup> (2.1 MG) combined sewer storage. By using existing infrastructure, the need for additional storage capacity was reduced to just 3,000 m<sup>3</sup> (0.8 MG).

Three additional water reuse facilities were equipped with AQUAVISTA in 2012 and 2013 to ensure stable, optimized operations while maximizing operational savings.

## Compliant effluent at the lowest cost

In 2017, the AQUAVISTA Plant platform was adopted to provide integrated optimization of Agtrup, the three satellite reuse facilities, and the sewer network for the City of Kolding.

"AQUAVISTA plant is now cloud-based, and that means that our data security is on a very high level and that's very important to us," said Per Holm, chief executive officer of BlueKolding. "It makes it possible for us to have an overview on our cell phones or any mobile device, and on our computers in the office as well."

By adopting AQUAVISTA, BlueKolding has achieved compliant operations under all conditions. Karin Refsgaard, operations manager at BlueKolding, highlights another key operational benefit from the optimization software: "We can use the basins to store spare water when electricity is

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expensive and so when electricity is cheap, we can pump the water and clean it and so we save money,” she said.

“It’s helping us to act more sustainably on a daily basis,” Holm emphasized. “All in all, we have a lot of opportunities to be more efficient as a utility company.”

### **Beyond municipal water, beyond Europe**

Alongside conventional municipal water resource recovery facilities, such as those at BlueKolding, digital optimization tools are also yielding results for other sectors that potentially rely on water reuse.

For example, a coke production site in Northern Europe has reduced total-N in its effluent by 50 percent – allowing the facility to comply with new and more stringent regulations and eliminate the need for significant capital expenditure that would otherwise have been incurred.

Beyond Europe, the City of Liberal (in the US state of Kansas) is constructing a new water resource recovery facility to handle increases in flow with improved treatment capabilities.

A combination of solutions is being provided to help treat average peak flows of up to 26,875 m<sup>3</sup> per day (7.1 MGD), while achieving effluent total-N of less than 8 milligrams per liter (mg/l), total phosphorus of less than 0.5 mg/l, and suspended solids of less than 5 mg/l.

Underpinning the treatment system with IIoT-functionality, the AQUAVISTA system will be used to provide remote data monitoring and access from internet-enabled devices.

Fully flexible, real-time digital optimization solutions can be implemented for just a single facility but can include multiple water resource recovery installations and sewer networks, as well as applications in the food and beverage, pulp and paper, and other industrial sectors that are reliant on water for their processes.

Significant operational advantages are achievable, even when managing large variations in biological loads and flow volumes. Perhaps most significantly, though, digital optimization solutions can help businesses and organizations meet their key sustainability goals to secure their long-term success.

### **Author’s Note**

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