

# INNOVATIVE TECHNOLOGIES FOR ENERGY MANAGEMENT IN THE WATER SERVICES SECTOR

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“Between the injured guy and the pregnant lady we figured we could co-moderate this session”, remarked World Bank Program analyst Kathia Havens, taking the stage after the morning’s coffee break. Onscreen she was joined by World Bank Croatia’s Stjepan Gabric whose Forum attendance had fallen victim to an ankle injury, and who, in his introductory statement, reminded the audience that while many in the sector, including himself, might still be in a state of denial, the current energy price-related crisis was no temporary deviation, but rather the sector’s future standard operating environment: “Yes, this is worrying and concerning, but on the other hand we should remember that crisis and necessity is mother of all innovations. In times of plenty we did not push too hard for innovation because there was no pressure on us, and pressure is main driver of technological progress.”

To show what kind of options technology has to offer in the current situation, the organizers decided to present both the user and the producer angle, inviting one water and one wastewater utility to present their approaches to on-site energy generation - and also inviting leading European tech companies in Europe to present the state of development.

First, Jeliaz Ranglov, Senior Manager of the Kubratovo wastewater treatment plant in Sofia introduced operator Veolia, a global company with a long proud history and great ambitions in the field of ecological transformation. Veolia has a considerable footprint in 14 countries in CEE and runs three operations in Bulgaria, among them the Kubratovo wastewater treatment plant, designed in 1970, commissioned in 1984, and until recently the biggest WWT on the Balkan peninsula.

Mr. Ranglov walked the audience through a long line of improvement measures, starting 1996 with the reconstruction of the sludge treatment facilities and leading through six stages to building a fifth digester in 2019/20. In the field of energy efficiency improvement, the plant installed a new double membrane gasholder in 2016, heat recovery from CHP exhaust gases in 2017, next generation blowers in 2017, an additional 7000m<sup>3</sup> digester in 2020, and the Hubgrade™ Performance Plant control system for improved efficiency in many fields of operation in 2021.

Starting from zero in 2008, the plant achieved 100% energy self-sufficiency in 2014 and has spent the last five years oscillating between 100 and 120%. Now Veolia is approaching the vision of an energy independent water supply system for Sofia.

The municipal water utility company of the Austrian capital, Vienna Water, follows a similar course, as shown in the mornings next presentation by Vienna Water Staff Unit Manager Wolfgang Gruber.

The company spends an enviable 0,17 kWh per m<sup>3</sup> delivered water and produces an annual 63 GWh in 16 drinking water-driven hydroelectric power plants in its system. In addition, Vienna Water draws 2 annual GWh from photovoltaic plants, with several more in the planning stadium as part of Vienna's ambitious solar energy offensive. In flanking measures, Vienna Water is choosing electromobility wherever possible and using facade greening as a natural air condition on its headquarters in a pilot project monitored by the Technical University and the University of Natural Resources and Life Sciences in Vienna.

An important technology partner of Vienna Water is also a supporter of the Forum: Siemens, this morning represented by Gilbert Schreiber, Head of Vertical Water & Environment for Central & Eastern Europe. In his presentation on Energy Management for Water Applications, Mr. Schreiber stressed that while technology can work wonders in terms of creating efficiency, the beginning of every process is about creating transparency, and that, as he puts it, is "not about technology, it is about simply doing things right."

Investing into smarter processes holds enormous promises, with the potential for energy saving in wastewater treatment plants adding up to 4,4 TWh p.a., or 150 million Euros in Germany alone. The current energy crisis is pushing digitalization, predicting, measuring and optimizing up the ladder towards the engineering and management level.

Siemens recommends a vertically integrated approach with a strong focus on making processes, histories and trends transparent and visible for both operators and decisionmakers: "Connecting to people is most important. Remember that technology must serve the people, not the other way around", commented Mr. Schreiber. The Siemens Energy Manager Pro tool creates the necessary visibility, showing operators intuitively what they can do to improve a process.

Mr. Schreiber closed his presentation with a short peek at two projects. One was the energy management of the Singapore Public Utilities Board, which resulted in major reductions of the energy consumption of altogether three wastewater plants. The other was the migration of the process control software plus hardware conversion in the Vienna wastewater treatment plant, where a digital twin simulation and a smart step-by-step conversion process succeeded in achieving a totally smooth, never-needed-to-return transition. At the end of the project in 2020, the plant had achieved energy autarky.

A third current project is a dynamic process model for a small treatment plant in Croatia, which supports all common processes for water and wastewater and supports decision-making in planning and operation, including simulations of what-if scenarios during ongoing system operation. With a glance at this project, Mr. Schreiber remarked that provided everybody sticks to a simple, but highly efficient "measure-monitor-control-manage" cycle, the Danube region is in a good shape to be technically and economically ahead.

Subsequently the panelists convened, with quite a share present in the form of online statements. Jelyaz Rangelov, Wolfgang Gruber and Gilbert Schreiber were joined by World Bank Senior Water Supply and Sanitation Specialist Camilo Lombana Cordoba and Florian Kretschmer, Senior Scientist at BOKU university in Vienna, who is a leading researcher in an Interreg project dealing with renewable energy generation and energy efficiency at wastewater treatment plants. The University of Natural Resources and Life Sciences BOKU in Vienna has long put a strong focus on energy generation from wastewater, because, as Mr. Kretschmer remarked, “we see that the importance of renewable energy supplies keeps growing. In this context I must say that when we talk about energy, until recently used to refer to electric energy. But if we want to succeed in transforming the energy sector, we have to look at thermal energy as well. The European Commission stated that heating and cooling is already – and will remain - the biggest sector.”

Therefore Mr. Kretschmer’s team looked at ways to make a wastewater treatment plan not only electrically self-sufficient, but also produce a surplus in thermal energy. “Which has not been really relevant in times of cheap, abundant gas, but times are changing, and now we use excess thermal energy in local energy supply and heat supply. In the course of the project, Vienna installed six anaerobic digestors, but similar installations were also done in 163 treatment plants across Austria, in fact this has for decades been a common practice everywhere in Western Europe. Vienna made the all-important difference by installing Europe’s largest Wastewater heat recovery system in the effluent, recovering enough thermal energy for 100.000 households. “So we can tap into various sources. We have biogas for electricity and heat, we have heat recovery in the effluent, we can apply solar and wind power, and we can apply hydropower” comments Mr. Kretschmer.

Asked at what electricity price levels such a system would become competitive, the scientist replied that the price questions should take the backseat in such projects: “We should aim at electricity efficiency. We should generate electricity and heat out of what we have. We have started years ago with this integration of wastewater heat into local energy supply concepts, and already a year ago, when gas was still cheap, it was competitive. Prices are secondary, and if we have the energy available, and we must use it to increase system resilience and supply security.”

Another perspective was then added by Camilo Lombana, World Bank Senior Water Supply and Sanitation Specialist with focus on water sector reform and utility strengthening. “Innovation should go beyond technology,” he said. “It is not only about having these mega investments to bring out even more energy. It is also about how utilities can be innovative on a daily basis to be more energy efficient. Because in the end it comes down not to how much more energy you bring on, it is about how you close the balance.”

Mr. Lombana advocates sets of small interventions, measures and initiatives that can produce surprising amounts of change, for instance the introduction of smart metering to better understand the energy consumption: “The key point is to measure, and mind that big data does not necessarily need big expensive investments. Still, it can have a big impact when utilities go about improving their energy balance.” While Mr. Lombana acknowledges that utilities are run by water experts, not energy experts he knows that many have close connections to and cooperations with energy providers and could engage with them in search of innovative approaches. Likewise, it makes sense to enter partnerships with solution providers to test innovative approaches without the need for large expenditures and efforts. Summing it up, Mr. Lombana states that energy efficiency is about the daily management of a utility and a relentless management drive to save energy.

Regarding the “next big thing” in innovative water technology, Siemens representative Mr. Schreiber would not point to artificial intelligence. Rather, he named digital twins as the current hot topic: “Everybody was looking at the process, but now colleagues, not only in the big treatment plants, are looking at simulation and model-based optimization at various complication levels. Indeed, currently we see more and more modelling.

The last 15 minutes of the session were dedicated to questions from the audience. Here, the interest was clearly focused on the chances of marketing excess energy production.

Regarding the chances of water utilities to enter the demand response market, Siemens representative Steffen Händler is quite optimistic: “I see big potential here, if you have installed digesters with gas storage and increase your power generation capacities you can use those to take part in the demand response market and make money there – and also to avoid expensive peak loads in your own plant.

Mr. Kretschmer agrees that there is great potential but stresses the need for an integrated approach: “If you want to integrate different ways of thinking, like wastewater treatment, water pollution control, water and energy supply security, you have to bring all stakeholders to the table, you need the appropriate data and you also need a common platform to manage all this.”

Winding down the session, Sofia Water’s Lyubomir Filipov asked how the exceptionally conservative water sector could ever hope to become an innovation leader – to which Camilo Lombana adds that, being slow to innovate, the sector fails to attract young talent, which in turn makes sector players less competitive and less efficient.

There was wide agreement that the current huge hike in energy prices could produce the necessary pressure that had up to now been lacking. At the end of the session there was also total agreement that this theme would remain with the sector for all of the foreseeable future and beyond.