2nd European Water Association Spring Conference
May 10 – 11, 2017, Lisbon, Portugal

Framework for improved energy management in smaller decentralized wastewater treatment plants

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The approach to wastewater treatment varies from conventional centralized infrastructures to decentralized systems, which collect, treat and reuse/dispose the wastewater at or near its generation point. The small size and the dispersion across the territory have led to a largely unattended operation of many of the decentralized wastewater treatment plants (WWTPs), with periodic visits of operators for treatment process control. It is thus important to address decentralized WWTP operation issues resulting from remote location.

In parallel, energy use is a growing concern at wastewater treatment facilities. It is crucial to identify the main uses of energy in WWTPs and to develop guidance and strategies to increase the energy efficiency of these infrastructures. Extended aeration is the treatment system frequently used in small to medium size WWTPs and the unit energy consumption for this type of treatment is higher than for the conventional activated sludge system.

It is important to apply a comprehensive approach for identifying and implementing opportunities for improving the performance of small dimension, decentralized WWTPs in a "plan-do-check-act" cycle routine. This approach integrates the WWTP's global diagnosis, using a Performance Assessment System based on performance indicators and indices, with the treatment system dynamic modelling for assessing and predicting the WWTP response to influent variations and to different sets of operating conditions and improvement measures. For example, this integration allows the sound proposal of aeration management options with a good potential for good performance both in terms of effluent quality, carbon and nitrogen removal and energy consumption and costs.

This communication presents an expedite framework to guide the decision-making process for energy management, which comprehensively integrates a performance assessment system (with performance indicators and indices) and mathematical modelling. The framework architecture and metrics are applicable to all WWTPs (small and large size), but the treatment systems addressed and the reference values and benchmarks are scale-specific.

Acknowledgments

The research leading to these results has received funding from European Union LIFE programme under grant agreement LIFE14 ENV/PT/000739.

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