Digitalization of sewage sludge treatment plants: the case study of Acquedotto Pugliese SpA (Apulia, Italy)

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Wastewater treatment generates a large amount of sludge, characterized by various contaminants (such as heavy metals or pathogens) but also valuable organic matter and nutrients (such as nitrogen and phosphorus). Sustainable management of sewage sludge is a major concern in wastewater treatment plants.

In recent years, the digitization of treatment plants through the creation of high-fidelity virtual models of physical entities has attracted widespread attention from the global industrial and academic communities. Digitalization is revolutionizing this sector, improving the efficiency and sustainability of processes.

Acquedotto Pugliese S.p.A. manages 185 wastewater treatment plants in Puglia, a region with specific environmental and operational challenges. In particular, the issues related to sludge management include: 1) the reduction of sludge volume; 2) the improvement of sludge quality; 3) the reduction of environmental impact to promote a circular economy (i.e., resource recovery).

This research concerns digitizing the 38 wastewater treatment plants with anaerobic digestion processes to improve biogas production. For this purpose, analyzing plant schematics and their technical performance was essential. The results show that integrating digital systems allows for real-time monitoring, optimized resource management, and reduced operational costs. This research is a survey on sludge management in the treatment plants of Acquedotto Pugliese S.p.A., providing an overview of the state of the art and laying the foundations for future developments.