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WHEN IT COMES TO QUANTIFY ENVIRONMENTAL INDICATORS OF THE WATER-ENERGY NEXUS IN WASTEWATER AND SLUDGE TREATMENT

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Wastewater treatment plants (WWTPs) have been developed as multifunctional systems responsible for the management and treatment of wastewater prior to its discharge into the aquatic environment. Within this framework, one of the central processes of the WWTPs is the Anaerobic Digestion (DA) process, a well-developed technology for the management of wastewater and solid waste with a high organic load. The objectives of AD are rooted in the underlying principle of the Circular Economy such that waste is recovered to produce bioenergy and biofertilizers.

The aim of this study was to assess the environmental and economic performance using the life cycle assessment (LCA) methodology and economic analysis of two sludge management scenarios, including a range of technologies applied to sludge to provide meaningful information on the identification of potential benefits (in terms of biogas production) and to identify associated impacts.

Scenario 1: consists of a thickener, conventional anaerobic digestion (AD) with cogeneration and a composting plant to reuse sludge in land application.

Scenario 2: consists of a thickener, a thermal hydrolysis pre-treatment followed by AD with cogeneration and a composting plant as scenario 1 for reuse of sludge in agriculture.

The functional unit (FU) is the quantitative reference from which the results of the environmental profiles are presented. Based on studies that consider the treatment or pre-treatment of sludge¹, FU is defined as 1 kg of mixed sludge. The system boundaries are limited to the operating phase in which the main impacts occur². The environmental impact in scenario 2 is 15% lower than in scenario 1, but costs increase in scenario 2 (10%). THP improves the amount of biogas in approximately 4%. The biogas valorisation in the WWTP is important to reduce the energy consumption of the network and to promote green energy (Figure 1).

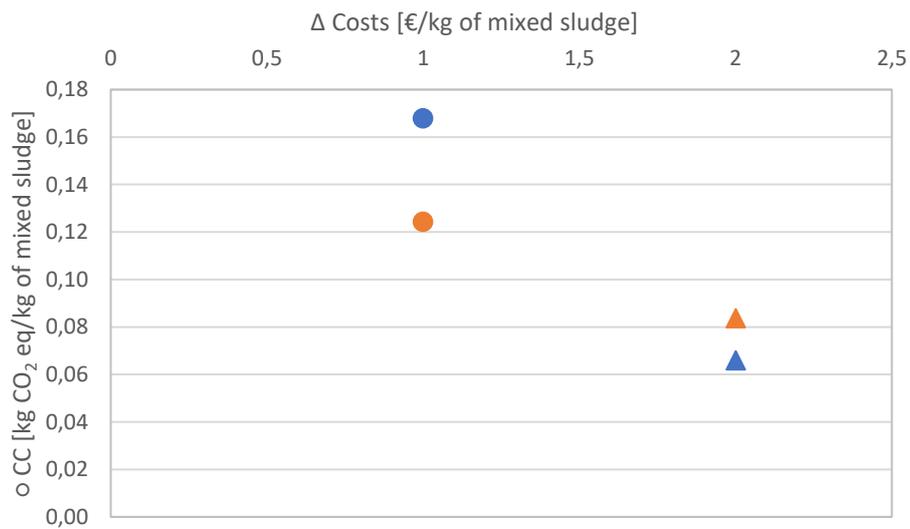


Figure 1: Climate change (CC) category and cost per kg of mixed sludge

The TH + AD processes have environmental benefits despite the large investments, but the possibilities of recycling the amount of energy would allow a reduction in the overall costs of the entire WWTP, which today represents a major problem.

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