Environmental Impact Assessment for a biosolids gasification pilot plant in Rethymno, Greece

A. Manali, N. Mavrakis and P. Gikas*
Design of Environmental Processes Laboratory, School of Environmental Engineering Technical University of Crete, 73100, Chania, Greece
*Corresponding author: E-mail: petros.gikas@enveng.tuc.gr, Tel +30 28210 37836, Fax: +30 28210 37851

Abstract
An integrated microsieving-drying-gasification industrial scale pilot plant, for biosolids to electric energy, is currently under installation at the Wastewater Treatment Plant (WWTP) of Rethymno, Crete, Greece. The construction and operation of such size demonstration plant requires the issuing of Environmental Terms, so an EIA study has been carried out. To the best of the knowledge of the authors, this is the first EIA for exclusive gasification of biosolids, thus, the composition of such study posed a number of challenges. As the aforementioned project is partially financed by the European research programme LIFE (LIFE16 ENV/GR/000298), by definition it is characterized by high innovation and originality (no project with similar characteristics has been executed).

The aim of the present project is to investigate a viable solution for the improvement of the quality of WWTPs effluent, at reduced energy needs, with parallel management of the biosolids problem. The examined process involves the upfront removal of biosolids (upstream of the aeration tank), using a microseive, followed by moisture removal and then gasification for the produced syngas. Syngas is then combusted in an Internal Combustion Engine (ICE) for the production of thermal energy (used for biosolids drying) and electric energy (used for the operation of the plant, while the excess may be exported to the WWTP or to the grid).

An industrial scale demo pilot plant is under installation at the premises of the municipal WWTP of Rethymno (population about 35,000 inhabitants), with daily wastewater flow between 10,000-15,000 m^3. The capacity of the demo plant will be 5,000 m^3/d, with expected Primary Sieved Solids (PSS) production of about ½ ton/d (dry basis). The gasifier has been designed so to consume all the daily production of PSS, operating on a 24h per day basis. An ICE will be employed to combust the produced syngas, so that the produced thermal energy to be conveyed to the dryer (to cover 100% of its thermal needs), while the electrical energy to cover 100% of the needs of the demo plant and the excess electric energy to be exported to the grid.

The demo plant will have an overall positive environmental footprint, as the process will enhance the performance of the WWTP, due to the removal of a large fraction of SS and BOD from the wastewater prior to the aeration tank. Moreover, net electric energy will be produced, while the production of municipal sludge (a nuisance substance) will be reduced. Along with the above, a net reduction of about 140 kgCO_2/day is expected. As for any industrial system, negative impacts are primarily related to the production of various by-products. In the studied case, the main by-products are (i) the scrubber effluents from the syngas cleaning process, (ii) the solid residue (ash), and (iii) the evaporated water from the dryer along with the exhaust gases from the ICE. A tight inspection and maintenance program will be followed, for the early identification of leaks or failures, which will be instantly addressed.

Acknowledgements
This study is supported by the Green Fund and the LIFE project (EC): “New concept for energy self-sustainable wastewater treatment process and biosolids management (LIFE B2E4SustWWTP)”, LIFE16 ENV/GR/000298.

Keywords: environmental impact assessment, wastewater treatment plant, microsieve, gasification, biosolids