

Life Cycle Assessment of Biogas Energy Production from a Small-Scale Wastewater Treatment Plant in Central Mexico

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Abstract : A great percentage of the wastewater generated in developing countries don't receive any treatment, which leads to numerous environmental impacts. In response to this, a paradigm change in the current wastewater treatment model based on large scale plants towards a small and medium scale based model has been proposed. Nevertheless, small scale wastewater treatment (SS-WWTP) with novel technologies such as anaerobic digesters, as well as the utilization of derivative co-products such as biogas, still presents diverse environmental impacts which must be assessed. This study consisted in a Life Cycle Assessment (LCA) performed to a SS-WWTP which treats wastewater from a small commercial block in the city of Morelia, Mexico. The treatment performed in the SS-WWTP consists in anaerobic and aerobic digesters with a daily capacity of 5,040 L. Two different scenarios were analyzed: the current plant conditions and a hypothetical energy use of biogas obtained in situ. Furthermore, two different allocation criteria were applied: full impact allocation to the system's main product (treated water) and substitution credits for replacing Mexican grid electricity (biogas) and clean water pumping (treated water). The results showed that the analyzed plant had bigger impacts than what has been reported in the bibliography in the basis of wastewater volume treated, which may imply that this plant is currently operating inefficiently. The evaluated impacts appeared to be focused in the aerobic digestion and electric generation phases due to the plant's particular configuration. Additional findings prove that the allocation criteria applied is crucial for the interpretation of impacts and that that the energy use of the biogas obtained in this plant can help mitigate associated climate change impacts. It is concluded that SS-WWTP is a environmentally sound alternative for wastewater treatment from a systemic perspective. However, this type of studies must be careful in the selection of the allocation criteria and replaced products, since these factors have a great influence in the results of the assessment.

Keywords : biogas, life cycle assessment, small scale treatment, wastewater treatment

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