

Life cycle assessment as a decision support tool in wastewater treatment plant design with renewable energy utilization

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ABSTRACT

This study presents how the life cycle assessment (LCA) approach was used as an analysis and decision support tool to formulate and finalize the design of a biological wastewater treatment plant (BioWWTP) for Bartın Province, Black Sea Region, Turkey. The system was designed to serve not only for its primary goal of treating wastewater, but also for providing an integrated engineering solution to today's multi-dimensional environmental problems and offering an installation serving for the well-being of the society and the environment. The design was improved by using photovoltaic panels for energy generation and rainwater harvesting, constructing a natural conveyance channel and a recreational pond to collect and retain water prior to discharge. The sequential phases of LCA were implemented, various cases were structured, multiple scenarios were tested, scenario analyses were conducted and results were comparatively evaluated. In one of the cases tested (Case-1), results implied that placing photovoltaic panels over the biological treatment units to meet 60% of the electricity demand of the system helped, i.e., reduce the global warming potential, hence the carbon footprint of the system by 50%, while mediating the use of a renewable energy source and enabling rainwater harvesting for possible water recycling-reuse; thus contributing to the sustainability of the entire installation.

Keywords: CO₂ emissions; Environmental impacts; Life cycle assessment; Photovoltaic panels; Scenario analysis; Sustainability; Wastewater treatment

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