



Development of Waste-to-Energy Systems in Urban African Mining Wastewater Treatment Plants: Carbon Footprint Reduction Analysis

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Abstract

Urban mining wastewater treatment plants in South Africa generate significant amounts of waste that can be harnessed for energy production through Waste-to-Energy (WtE) systems. A detailed process simulation model was employed to evaluate the energy output from anaerobic digestion and biogas combustion processes under varying conditions. The analysis revealed a consistent reduction in carbon footprint by approximately 30% when compared to conventional wastewater treatment methods, with specific operational parameters optimised for maximum efficiency. WtE systems offer a promising avenue for reducing the environmental impact of urban mining waste streams, demonstrating significant carbon emission reductions through optimal system design and operation. Further research should focus on integrating WtE technologies into existing infrastructure to maximise their potential in mitigating climate change impacts from mining activities. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u + v + \epsilon$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African, anaerobic digestion, biogas, life cycle assessment, renewable energy, sustainability, wastewater treatment*

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