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LANDFILL GAS TO ENERGY CONVERSION FROM ORADEA MUNICIPAL WASTE LANDFILL IN ROMANIA

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Abstract

This paper presents the results of theoretical estimations of the quantity of landfill gas (LFG), as well as the energy potential of Cell A from the municipal landfill in Oradea city, Romania, based on a mathematical model. Considering three scenarios for LFG recovery according to the capture system efficiency, the following LFG theoretical flows have been obtained: 157 m^3_{LFG}/h for 45% recovery efficiency; 209 m^3_{LFG}/h for 60% recovery efficiency; and 297 for 85% recovery efficiency, respectively. The current recovery system efficiency based on real data is about 45%. On-site measurements revealed that the LFG composition is 53% methane and 0.72% oxygen, thus, it is suitable for electrical energy generation using internal combustion engines. Consequently, by considering 35% motor-generator system efficiency and previous flows of LFG, the electric energy to be obtained is 299 kW_e, 398 kW_e, and 564 kW_e, respectively. At the same time, the electric energy of 281 kW_e has been obtained for the real data of the LFG flow of 148 m^3_{LFG}/h. Considering that the operating time is 7,446 h/yr; the energy generated for the year 2014 is 2,092 MWh_e. On the other side, from 2005 to 2030, according to the recovery system efficiency, the total electrical energy generated during this period is 40,222 MWh_e; 53,630 MWh_e and 75,975 MWh_e respectively, and the methane emissions have been estimated for about 1.53 million m^3_{CH4}, which represents 417 thousand of tons CO_2 equivalent, which may be reduced by using LFG for producing electricity.

Keywords: energy, landfill gas, mathematical models, methane emissions, solid waste

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