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 m³LFG/h for 45% recovery efficiency; 209 m³LFG/h for 60% recovery efficiency; and 297 m³LFG/h 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 kWₑ, 398 kWₑ, and 564 kWₑ, respectively. At the same time, the electric energy of 281 kWₑ has been obtained for the real data of the LFG flow of 148 m³LFG/h. Considering that the operating time is 7,446 h/yr; the energy generated for the year 2014 is 2,092 MWhₑ. 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 MWhₑ; 53,630 MWhₑ and 75,975 MWhₑ respectively, and the methane emissions have been estimated for about 1.53 million m³CH₄, which represents 417 thousand of tons CO₂ 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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