

Model calculations of the quantities of landfill gas, emitted from the landfill for solid domestic waste in Blagoevgrad (village of Buchino)

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Abstract: *The biogas released from the landfills has got a noxious effect. It also creates the most serious environmental problems after the landfills closing. The gas releases actively for more than 25 years. That is why extremely high requirements for its utilization have been set today. The first step in this direction is the determination of its amounts. A prognosis for the quantities of gas released from the landfill at the village of Buchino has been made in the present report. The used mathematical model of prognosis has been adapted for the conditions in Bulgaria on the basis of the authors' experience gained during their observations and research of a number of landfills in the country*

Keywords: landfill gas, biogas, RES

INTRODUCTION

Closing of most of the landfills for domestic waste in our country which do not meet the contemporary requirements for construction of this kind of facilities is scheduled in the current and in the next year. In fact, these are landfills of municipalities (excluding those of the biggest towns), established long time before the actual standards for construction of landfills for domestic waste have been determined. However, closing of these landfills does not solve the problems with the emissions of harmful substances from them. The main problem from the environmental point of view is the emitted from the landfills for domestic waste landfill biogas. The landfill gas has been emitted actively for more than 25 years after the disposal of the waste. For this reason extremely high requirements are set for its disposal.

Objectis

The landfill in the village of Buchino, servicing the municipality of Blagoevgrad, is a typical landfill, for the closing of which particular measures are taken. The objective of this report is to present an approach for determination of the quantity of landfill gas, emitted from the landfill.

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One of the important conditions for the determination of the method of extraction of the landfill gas and selection of a technology for its disposal is to have available data about the expected quantities of emitted gas.

For this type of landfills for domestic waste and in particular the one in the village of Buchino, there are no monitoring and carried out experiments for determination of landfill gas emissions. The available data refer mainly to summarized quantitative values, without morphological structure studies, etc. When speaking about quantities, the established standard of accumulation of waste per resident should be taken into account. Based on the studies carried out by us, we have established the following accumulation rate (for the towns, where there is a relatively precise measurement of the disposed waste) – fig. 1. In other words, it can be reckoned in general for the estimation of the quantity of the emitted landfill gas, that the accumulation rate is 1 kg/day/resident.

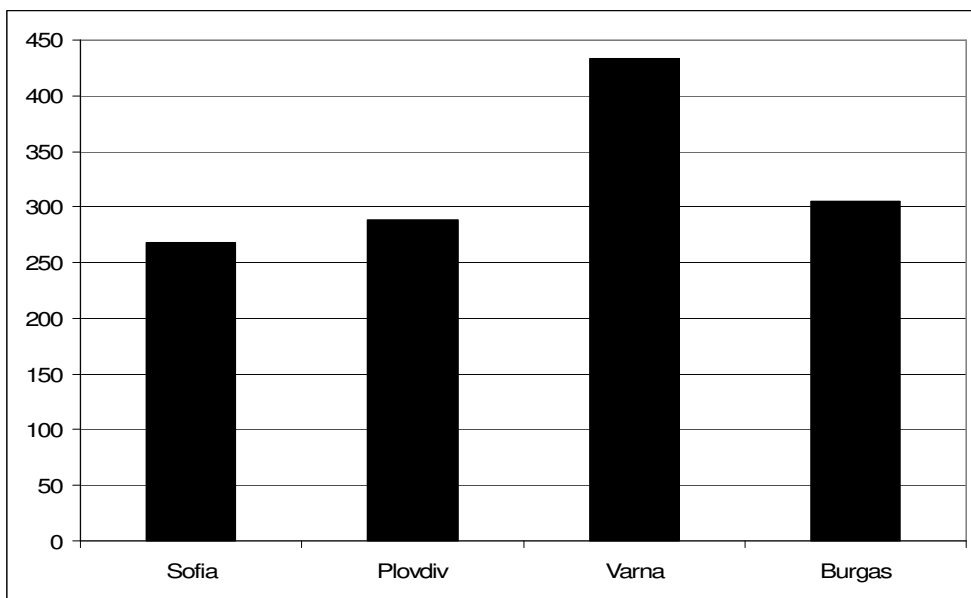


Fig.1 Accumulation rate is 1 kg/day/resident to Sofia, Plovdiv, Varna and Bourgas

These deductions are proven also for the municipality of Blagoevgrad, based on the landfill volume, the density of the disposed waste and the filing level.

For estimation purposes of the quantity of emitted landfill gas it can be supposed that annually the landfill in the village of Buchino receives approximately 30.000 tones of waste.

We have made our estimations using the so called first-order model. In this model the dynamic of emissions of landfill gas is a falling exponent and is shown on fig. 2.

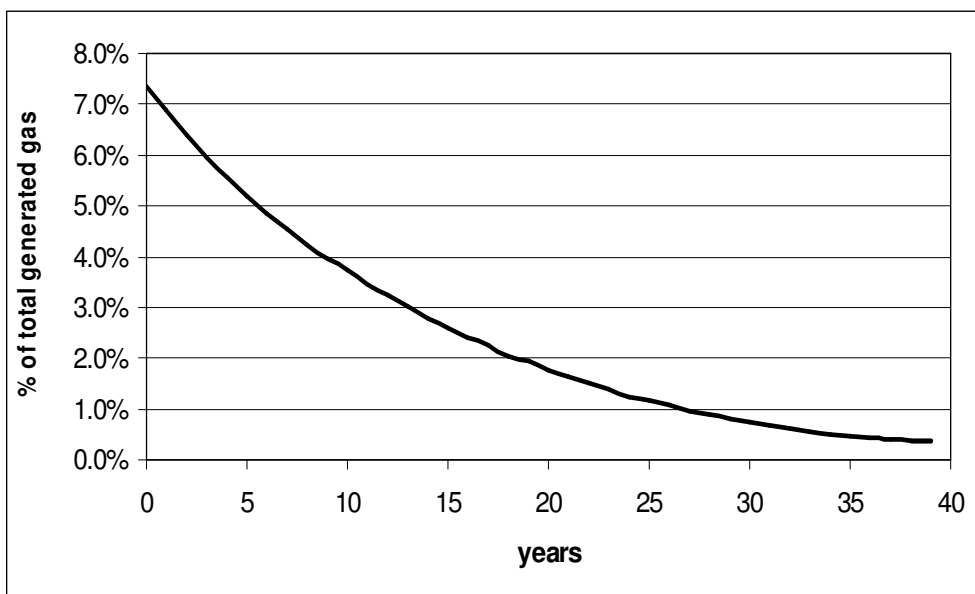


Fig.2 Intensity of gas generation

RESULTS

For the landfill in the village of Buchino it may be supposed that from 1 ton of waste the landfill gas, which may be caught, amounts to 40 m³. This relatively low amount is accepted because of occurring self-ignition of the landfill.

According to these data the following estimations of the emitted quantities of landfill gas are calculated – Fig. 3

In terms of opportunities of landfill gas recovery the energy, which may be generated by it is of interest. The fuel component in the landfill gas is methane. For methane content of about 50% the fuel value of the landfill gas is shown on Fig. 4.

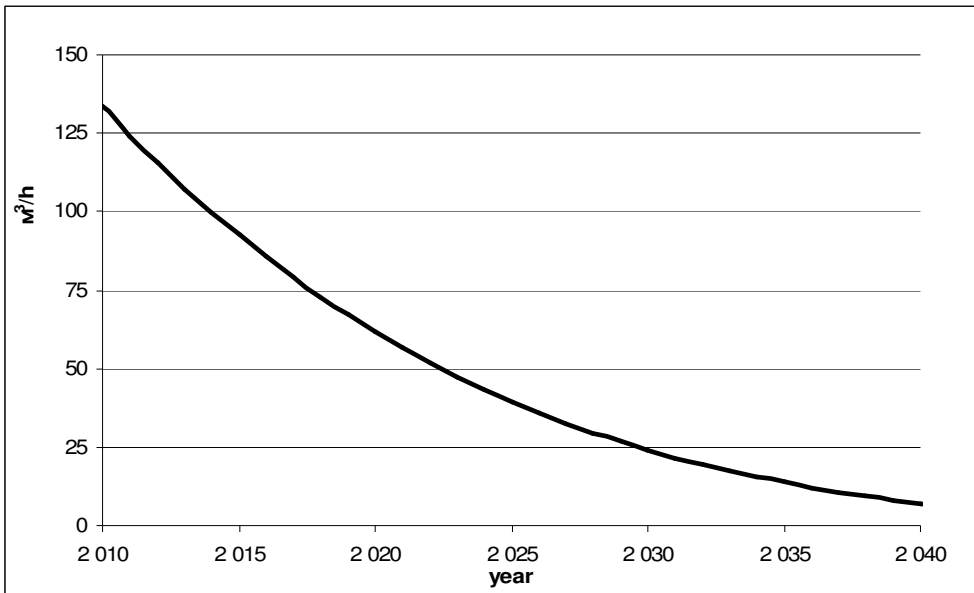


Fig.3 Landfill gas flow

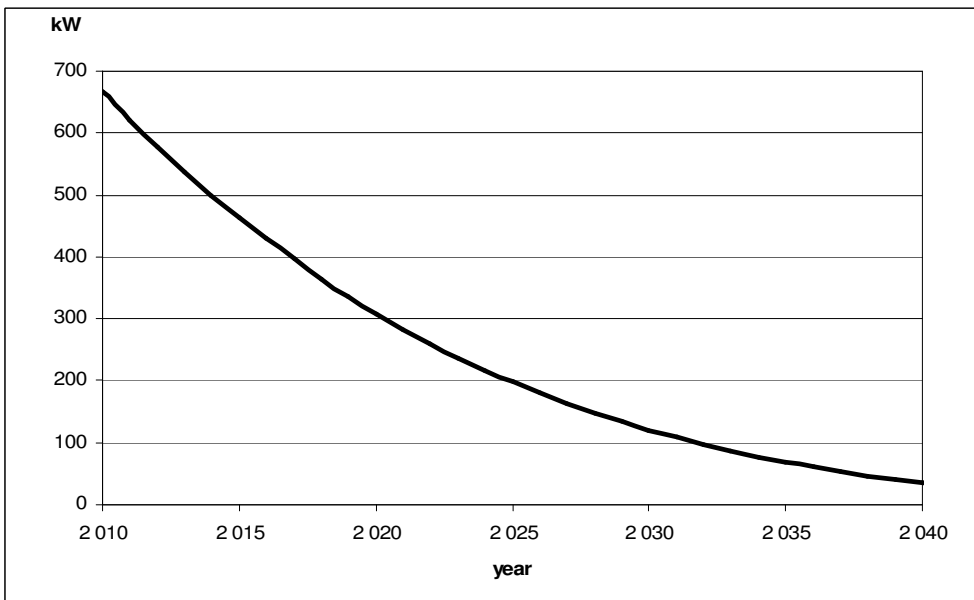


Fig.4 Energy potential

CONCLUSIONS

Although the expectations provide a relatively limited flow rate of landfill gas from the landfill in the village of Buchino, the gas emission should be controlled through construction of gas wells and its forced extraction and disposal must be organized. After having gas wells constructed an analysis of the quantity and the quality of the emitted landfill gas with relevant accuracy will be possible.

REFERENCES:

- [1] Exploring Opportunities for Landfill Methane Recovery, 2005, USA, <http://www.epa.gov/lmop/>
- [2] *Air Emissions from Municipal Solid Waste Landfills-Background Information for Final Standards and Guidelines*, U.S. EPA, 1996.
- [3] Scharff, H., Joeri Jacobs (2004) *Comparison of methane emission models and methane emission measurements*, 3rd Intercontinental Landfill Research Symposium, Toya Lake, Japan, November 29-December 2, 2004.,