TECHNO-ECONOMIC ANALYSIS OF THE POSSIBILITY OF UTILIZING BIOMASS AS AN ENERGY SOURCE FOR BIOGAS PRODUCTION

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Waste management efficiency can be considerably increased through utilization of the materials and energy potential of waste, which economically enhances the system as a whole. Particular attention should be primarily given to biological waste that has huge potential. Under anaerobic conditions, i.e. without air, methane, an energy carrier, is released from biomass. Methane is the major constituent of natural gas (95%), landfill gas (50-60%) and biogas (60-70 %). Estimate of the production of biogas from individual biowaste materials are given in the paper.
Landfill gas is generated in municipal waste landfills for 20-30 years and its composition substantially changes, being dependent on individual landfill characteristics, type of deposited waste and method of disposal.
A considerably more effective method of utilizing the energy potential of biowaste is provided by separate biogas stations. These stations are designed to produce maximum energy from waste and to further utilize it. Biogas stations can be set up next to wastewater purification plants, near big companies generating biological waste (slaughterhouses, sugar plants, alcohol industry), near agricultural companies engaged in livestock and poultry breeding, on landfills, etc. A typical scheme and description of a biogas station are given in the paper. The end-product of the biological waste treatment process is a product that contains about 50% of the original organic matter, being a high concentration, and that has optimal pH, due to which it is suitable to be used as an agricultural fertilizer.
Composting is another method of utilizing biological waste. This anaerobic process (using air) enables stabilization and hygienization of biowaste. Recently, many countries have introduced mechanical and biological waste treatment systems at landfills aimed at reducing the volume of waste deposited at landfills.
Calculation of energy balance in this paper is based on the fact that 200Nm3 of landfill gas is generated on average per ton of municipal waste over a 20-year period. An annual amount of 50,000 tons, generated in a city of 150,000 inhabitants and disposed of at a landfill over a 20-year period, would produce 200 million cubic metres of landfill gas. If about 50% of the above amount of gas was provided to gas engines through a gas collection system and quality control, about 100 million Nm3 of landfill gas, i.e. 5 million Nm3 on average annually or 625 Nm3/h would be used in the energy balance calculation. This amount of gas with Hu = 5kWh/Nm3 through GE Jenbacher gas engines enables an annual production of 9 million kWh of electricity and 12 million kWh of heat. The generated amount of electricity covers the need of 2,500 family households. This type of electricity production can save about 18,000 t of lignite in a lignite-fuelled power plant. This also means that 300 Nm3/h of landfill-derived methane (i.e. 300 x 0.718 = 215 kg/ha) is not released into the atmosphere, the fact being an important environmental aspect of using gas engines in preserving the ozone layer (one ton of methane has the same negative effect on the ozone layer as 21 tonnes of carbon dioxide). At the end of the first decade of the 21st century, economically justified spheres of interest and a climate suitable for investments to be made into biogas plants exist in Serbia.