

Research on the Landfill Gas Utilization Possibility on Municipal Solid Waste Landfill Suhodol for Electricity and Heat Energy Recovery

Sofia Energy Agency – SOFENA, Bulgaria

Summary

The municipality landfill Suhodol is located 1.2 km far from the Suhodol district of Sofia. The landfill is divided into two parts: the first has been in operation since 1994 to 1997 and some 500 000 t waste have been dumped there. The First part is closed and capped with an impermeable construction. The waste stored in the place is in real methane degradation phase and produces landfill gas with about 50% methane content. The second part is under operation since 1997.

A pilot plant might be constructed for utilization of the gas from the first part of the landfill and extended in the future to cope with the gas from the Second part of the landfill. The Project is regarded as one of a high priority for the City of Sofia. Such experience could be transferred to the other sites in Bulgaria as well.

The project has also environmental benefits. The methane as a main component of the landfill gas is a potent greenhouse gas with 21 times stronger impact to the global warming than CO₂. Landfill gas incineration will reduce: the methane emissions, the odour effect, and the risk of explosion.

End-user area	Target Audience	Technical
New buildings	Citizens	Energy efficiency
Refurbishment of buildings	Households	Heating
Transport and mobility	Property owners	Cooling
Financial instruments	Schools and universities	Appliances
Industry	Decision makers	Lighting
Legal initiatives (municipal regulations, directives, etc)	Local and regional authorities	CHP
Planning issues	Transport companies	District Heating
Sustainable communities	Utilities	Solar energy
User behaviour	ESCOs	Biomass
Education	Architects and engineers	Wind
Other	Financial institutions	Geothermal
	Other	Hydro power
		Other

Context

When biologically degradable organics are dumped with the unsorted waste in a landfill a process of degradation starts and continues between 20-25 years. Worldwide practice shows that the landfill gas produced as a result of this degradation may be profitably utilized. The experience in this area exists and a lot of proven solutions are available. The most appropriate technology that is widely accepted is the spark ignition gas engines. The waste heat from the engines can be used for district or greenhouse heating to increase the energy efficiency of the installation (cogeneration). To supply gas

to the engines, a series of wells must be sunk through the cap into the waste. Suction pressure must be also applied by means of blower and the gas must be purified. Wells, blowers and connecting pipes comprise the collection system and the gas engine and the connection to the national electricity grid comprise the power station. Both systems must be designed and constructed. Until now a manifold consisting of 11 wells and 2 trenches for landfill gas collection under the cap has been build in compliance with the existing project for landfill capping and re-cultivation. Sofia municipality aims to find effective solution for landfill gas utilization taking into account the world practice in this area.

Objectives

The project aims to reduce landfill gas emissions from the landfill and to produce electricity and heat. In this way an old problem will be solved with both social and environmental meaning and will ensure a stable income for the municipality. Landfill gas utilization is a widely spread practice in Europe and USA, but it is a new practice for Bulgaria and the experience and know-how could be transferred to the other areas in the country.

Process

The technologies for Landfill gas Utilization and the best world practices were investigated. The gas potential over 15 years time horizon was estimated in three different ways: by rule of thumb, by gas probes, by computer model. The place characteristics and waste composition were taken into account. The economics and investment possibilities, and a financial plan and prognoses were also presented.

Financial resources and partners

The Project was financed by Save II Programme of the European Commission.

Results

Worldwide practice shows that the landfill gas produced as a result of the unsorted waste degradation may be profitably utilized. The experience in this area exists and a lot of proven solutions were investigated and their pros and cons were discussed in the work. The most appropriate technology that is widely accepted and suitable in our case is the spark ignition gas engines. The waste heat from the engines can be used for district or greenhouse heating to increase the energy efficiency of the installation (cogeneration).

According to recent assessment made by Sofia Energy Agency some 280 m³/h landfill gas now evolved to the atmosphere can be recovered and utilized in a gas engine with 500 kW electrical and 800 kW heat capacity. The period of exploitation of the power station will be extended after starting to use the second part of the landfill in 2006. Then the electrical capacity will be increased to 2,5 MW and emissions of 5 000 tons/yr CH₄ (110 000 tons CO₂ equivalent) will be avoided.

Some preliminary calculations were made in order to define the investment (EUR 3 million) and O&M costs (EUR 200 000 annually) needed. The simple payback period was estimated to be 5 years. As a part of the investigation, some preliminary contacts with potential investors from Netherlands and Denmark were established. Possibilities to use mechanisms like Joint Implementation (Kyoto Protocol) or the scheme Built-Operate-Transfer (BOT) were discussed on municipal level.

Lessons learned and repeatability

In the last decade the waste management policy suffered big changes. The Bulgarian legislation has been changed to meet the European Union requirements and directives. Suhodol is a new modern landfill with an impermeable insulation preventing leakages and gas migration into the soil. There is a periodical monitoring of landfill gas emissions and gas-collecting wells are building in parallel to the

exploitation. After filling out the site is capped and in compliance to the Bulgarian legislation the collected gas must be flared or utilized.

According to SOFENA estimations landfill gas utilization using the First part of the landfill at the beginning is a profitable solution with big social and environmental benefits. The next step could be the extension of the plant after the Second part of the landfill is closed.

The experience could be transferred to the other landfills in Bulgaria. The installation could be used on the other sites, not only for utilization of landfill gas but also for gas utilization from sewage plants and other low calorific waste biogases.

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Printed reports or other literature available:

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