

Biogas analysis of landfills in Portugal

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The production of municipal solid waste (MSW) and its final disposal is one of the challenges of the present and future generations.

Sustainable development promotes the use of renewable energy sources. Currently the waste can be used to generate energy through the biogas produced by anaerobic digestion, in landfills, waste treatment plants and wastewater treatment plants (Kuhn *et al.*, 2017). Biogas produced in landfills is considered a renewable source of energy (Yechiel and Shevah, 2016).

In Portugal, MSW production has varied over the years, in 2010 around 5,184,000 tons were produced, dropping to 4,362,000 tons in 2013 and increasing again to 4,640,000 tons in 2016. The fraction of MSW sent to landfill has declined significantly from 62 % in 2010 (APA, 2016) to around 29 % in 2016 (APA, 2017). The significant reduction of the MSW amount sent to landfill is a consequence of the waste national strategy and the growth of biological mechanical treatment (BMT) infrastructures. The BMT allows the waste mechanical treatment followed by anaerobic digestion and composting.

It is expected that the MSW amount sent to landfill decrease further in the coming years due to the strategies and targets of each waste management entity in order to eradicate direct MSW landfill deposition by 2030 (APA, 2017).

Nowadays, there are 32 landfills in operation, but the actual number of closed landfills with biogas production is unknown.

In view of the decrease in MSW sent to landfills and in the percentage of MSW biodegradable it is expected that the amount of biogas produced will decrease significantly, and consequently energy production. In Figure 1 it is showed the Portuguese MSW composition in 2011 and 2016. Since 2011 to 2016 there is a reduction of the MSW biodegradable fraction from 55.2 to 50.7 % (APA, 2011-2016).

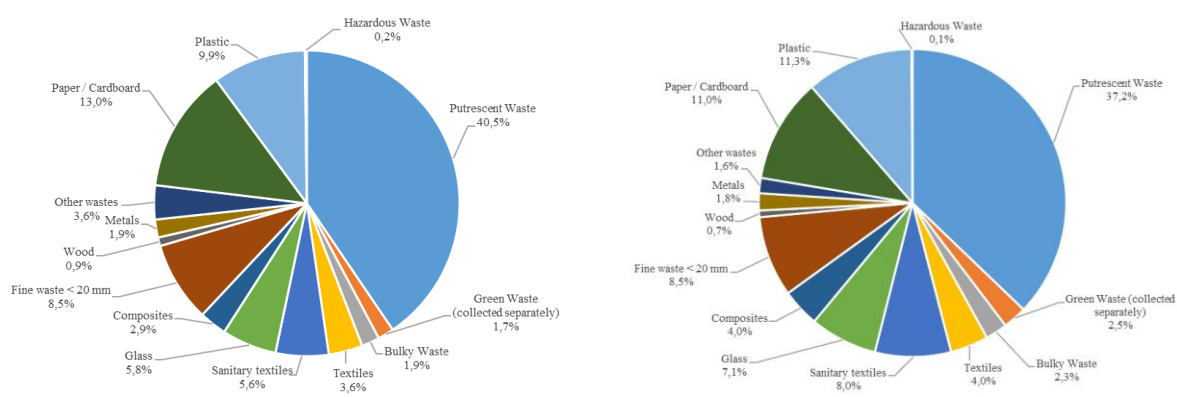


Figure 1. Portuguese MSW composition in 2011 and 2016.

The biogas produced in the landfill depends on several factors: waste amount and composition, average soil and wastes temperatures, landfill activity and sealing date, evolution of biogas production, among others. In most landfill biogas occurs in the first 20 years. In general, the landfill biogas composition should contain at least 55 % of CH₄ to be economically viable the energy recovery. Some of the landfills are reclaimed in landscaped terms after their closure. Such facts make monitoring of biogas every six months essential.

In Portugal, the energy produced by the biogas burning comes from landfills, wastewater treatment plants and solid waste treatment plants, representing only 1 % of total renewable energy sources. Landfill biogas accounts for 96 % of the total national production of this renewable energy (DGEG, 2014).

After an extensive literature research for closed landfills, data on biogas production are scarce and a case-by-case assessment is required.

The present work intends to carry out a survey of the biogas production from sanitary landfills in operation and closed landfills. Until now it was possible to estimate the total landfill volume and the amount of energy recovery by biogas, expressed in MWh for 2015 (Table 1) in the 23 waste management entities (ME, 2015-2016).

Table 1. Landfill volume and produced energy.

ME	Landfill volume (m ³)	Produced energy (MWh)
Algar	n.a.	14,025
Amarsul	n.a.	25,776
Ambilital	868,200	n.a.
Ambisousa	2,239,402	n.a.
Amcal	337,063	n. d.
Braval	n.a.	6,312
Ecoleziria	719,384	2,974
Ersuc	n.a.	12,605
Gesamb	n.a.	n.a.
Lipor	n.a.	n.a.
Planalto Beirão	1,817,659	7,001
Resialentejo	n.a.	n. d.
Resíduos do Nordeste	n.a.	4,500
Resiestrela	n.a.	4,076
Resinorte	n.a.	22,439
Resitejo	n.a.	n.a.
Resulima	1,650,000	n.a.
Suldouro	4,772,880	n.a.
Tratolixo	n.a.	n.a.
Valnor	n.a.	n.a.
Valorlis	n.a.	n.a.
Valorminho	n.a.	n.a.
Valorsul	6,396,000	23,168

n.a. – not available.

It is estimated that biogas production from the landfills in operation will allow an injection into the energy net around 190,090 MWh.

In Portugal, despite the production of MSW has increased since 2013 to the present there is a reduction of biodegradable MSW fraction and of the amount of MSW sent to landfill, therefore it is expected that the biogas production will decrease in the next years. The recovery of closed landfills has several associated environmental problems, namely the production of leaching water and biogas. According to the results obtained, some of the enclosed landfills present problems in biogas and leaching wastewater extraction. Generally, the biogas from old landfill does not have enough methane to produce energy. If there is no proper monitoring after landfills closure the methane release to atmosphere may occur, contributing to the greenhouse gases and representing serious risk to public health.

References

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