

## The LFG Baltic project – Lithuania and Poland

Andrius Tamosiunas<sup>1</sup> and Robert Aranowski<sup>2</sup>

<sup>1</sup> Lithuanian Energy Institute, Breslaujos g. 3, LT-44403 Kaunas, LITHUANIA

<sup>2</sup> Gdansk University of Technology, 11/12 Gabriela Narutowicza Street, 80-233 Gdansk, POLAND

### 1 Introduction

The LFG Baltic project is a seed funding project financed by the Swedish Institute, Gdansk University of Technology, Lithuanian Energy Institute and the Baltic Energy Innovation Centre.

The overall aim is to encourage the use of landfill gas as an energy resource and reduce aggressive greenhouse gas emissions from landfills by cross border knowledge exchange and technology transfer.

The activities include screening of landfill gas extraction and utilisation in Lithuania, Poland and Sweden, compilation of a Best Practice and Lessons Learned report.

Here the situation in Lithuania and Poland will be described.

### 2 Landfill gas in Lithuania

#### 2.1 Background

According to statistics there are more than 800 closed or still in exploitation landfills of different size [1]. In 1998 various type of waste was disposed in 314 landfills. However, waste disposal in the small landfills did not get into the statistics and therefore, a number of landfills in Lithuania might be much higher as expected. The situation has changed significantly after Lithuania became a member of the Europe Union in 2004.

#### 2.2 Current situation

According to EU regulations, 10 regional operating landfills should had left in Lithuania until 2010, but these conditions have not been fully implemented. So far, there are newly installed 14 modern active land-

fills: 11 regional landfills for non-hazardous (household) waste, 1 for hazardous waste, and 2 for construction waste [2]. All landfills have been installed and maintained according to strict EU requirements.



Figure 1. Regional Waste Management Centres (RWMC) in Lithuania.

In Lithuania exist 10 regional waste management centres (Figure 1). In 2005 the association, uniting all 10 centres, was established, which annually reports the summary of the achievements of all the members. As of year of 2017, total amount of waste managed in these centres exceeded 1,291,406 tonnes [3]. Municipal waste generated in 2017 in Lithuania was 455 kg per capita (EU-28 487 kg), which comprises quite the same amount of totally managed waste [4].

#### 2.3 Number of active landfills where landfill gas is extracted

So far, out of 11 new landfills only 4 declares the extraction of landfill gas. These

landfills are situated in Alytus region, Panevėžys region, Telšiai region and Utena region (see Figure 1). However, all 11 newly established landfills must have a possibility to extract landfill gas by installing a gas collection system. But, due to some technical, economical, infrastructural, terrain or gas quality and amount barriers, in some of newly operated landfills, gas extraction is still pending or limited.

#### 2.4 Closed landfills where landfill gas is extracted

So far, there are 8 landfills (closed and in operation) where landfill gas is extracted and used to electricity production (Table 1).

Table 1. Landfills where landfill gas is extracted and used for energy production.

Region, name of facility	Installed power		
	Total, kW	kW <sub>e</sub>	kW <sub>th</sub>
Vilnius, Kariotiškių	500	500	n.d.
Vilnius, Kazokiškės	1600	800	800
Kaunas, Lapių (in operation)	2740	1200	1504
Klaipėda, Glaudėnų	1640	1640	n.d.
Marijampolės	480	480	n.d.
Panevėžys	819	400	419
Šiauliai, Kairiai	1200	600	600
Alytus (in operation)	450	450	n.d.
<b>Total</b>	<b>9429</b>	<b>6070</b>	<b>3323</b>

#### 2.5 Use of the extracted landfill gas

Mostly the extracted landfill gas is used for electricity or combined heat and power (CHP) production. The produced energy (heat and electricity) in the operated landfills is mostly consumed in the internal technological process, except for the case of the Alytus regional landfill where around 38% of the produced electricity was sold to electric grids in 2017.

Currently, the price of electricity produced from landfill gas exceeds 8.68 ct/kWh. At

such a tariff, only 10–12 larger size landfills in Lithuania are of some interest for the investors to invest and make profit. In case of increased subsidies per kilowatt-hour for electricity production from landfill gas, a smaller size landfills might also be profitable and attractive for the investors.

### 3 Landfill gas in Poland

According to the National Waste Management Plan (2010), there were 764 landfills for non-hazardous waste and 34 landfills for hazardous waste in Poland. This list includes both closed and still active landfills [5].

At the end of 2017, there were 301 active landfills receiving municipal waste. These landfills occupied a total area of 1 741.6 ha. In 2017, about 92.5% of the landfills area was the area of active controlled landfills. The remaining part was the area of the so-called "wild landfills" i.e. places not designated for municipal waste storage. At the end of 2017, there were 1,661 illegal landfills in Poland [6-9].

#### 3.1 Number of active landfills where landfill gas is extracted

In 2017, there were 267 landfills equipped with installations for degassing, and they constituted 88.7% of all active landfills on which municipal waste was stored. Figure 2 demonstrated the map of Poland with division into regions where there were landfills with a degassing system and without degassing system [7].

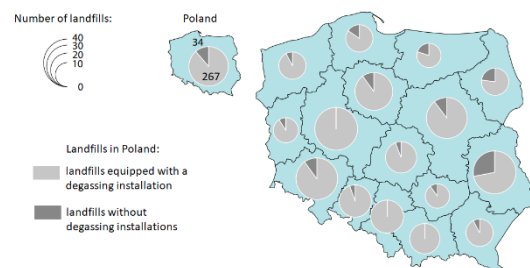


Figure 2. The map of Poland, which contains information on the number of landfills equipped with a degassing installation and without degassing installations [7].

About 37% of installations for degassing were installations with gas escaping directly into the atmosphere, while 6.6% were those where the gas was neutralized with the recovery of thermal energy. About 20.3% of the installations were used to generate electricity from landfill gas. In 2017, as a result of disposal by burning off the landfill gas, about 96,997 thousand MJ thermal energy and about 121,574 MWh of electricity were recovered. Almost 2,734.2 thousand tonnes of municipal waste, were allocated for energy recovery [7].

The number of biogas plants in landfills, after Poland's accession to the European Union in 2004, is gradually increasing. In 2012, there were 91 such installations with a total capacity of 54.456 MW. Currently, there are 98 biogas plants in Poland producing landfill biogas (in landfills) with a total capacity of 62.919 MW.

Table 2 presents the number of biogas plants operating in different regions of Poland in 2012.

*Table 2. Number of installations that convert landfill gas into thermal and electric energy and their power (30.09.2012) [8].*

Region	Number of installations	Power [MW]
Dolnośląskie	5	4.345
Kujawsko-pomorskie	8	3.814
Lubelskie	1	0.5
Lubuskie	1	0.5
Łódzkie	5	4.675
Małopolskie	6	2.928
Mazowieckie	21	11.956
Opolskie	1	0.45
Podkarpackie	3	1.511
Podlaskie	1	0.7
Pomorskie	4	3.557
Śląskie	15	11.738
Świętokrzyskie	1	0.36
Warmińsko-mazurskie	2	1.142
Wielkopolskie	7	5.09
Zachodniopomorskie	10	3.19
Total	91	56.456

Unfortunately, there are no available data for the current year.

The first installation using landfill gas to the production heat and electricity energy in Poland was launched in 1995 at the Żółwin landfill near Bydgoszcz. It was equipped with two generating sets with a total power of 200 kW. However, currently the largest landfill biogas processing stations operate in Katowice, Warsaw, Sosnowiec and Olsztyn Łęgajny (in Katowice and Olsztyn, about 500 m<sup>3</sup> of gas is extracted per hour), where biogas processing equipment with 800 kW and 1,200 kW capacity has been installed [8-10].

### *3.2 Closed landfills where landfill gas is extracted*

There is no official information about numbers of closed landfills where landfill gas is extracted. The installation producing thermal and electric energy on the inactive landfill is located, among others in Toruń, where biogas from waste is burned in three co-generators with a total capacity of 1,324 kW. The biogas is taken through 82 biogas wells. In 2011, 5,927 MWh of electricity and 20,454 GJ of heat were generated [11]. The gas landfill is also extracted from closed part of landfill in Opole. The biogas is transformed into electricity that is sold to the grid. Biogas on inactive landfills is also obtained in the Śląskie region. One of the largest is the biogas plant in the Tychy landfill with a capacity of 1.09 MW [11].

### *3.3 Use of the extracted landfill gas*

In Poland, biogas is only processed for electricity and heat. This is mainly due to the lack of adequate infrastructure around landfills and the relatively low potential of gas storage sites. In turn, electricity is mainly consumed in the internal technological process, as well as in operation of the sorting plants and the composting plants. However, heat energy is used to heat rooms and water in administrative build-

ings of a landfill. Only a part of the biogas plant sells the generated electricity to the grid. Most landfills are located far away from cities, therefore the generated heat is very rarely sold for heating water and residential buildings. The transmission of this type of energy is not viable due to the large heat loss during transport [8-15].

#### 4 Discussion and conclusions

So far, there are no existing schemes supporting landfill gas extraction from smaller size landfills with less amount of biodegradable waste in Lithuania. If the tariff on electricity production from landfill gas would be increased, there would be an interest from the investors.

In a short term perspective (10-15 years), the development potential of landfill gas extraction in Poland is significant. A large number of landfills with degassing installations consider the possibility of using biogas to heat and electricity production. This potential can only be consumed in the case of the use of landfill biogas enrichment facilities. Unfortunately, due to the lack of financial support and high investment costs of the biogas treatment, there are not too many such installations in Poland. Due to increasing limits of the calorific value of stored solid waste, in the long term perspective (20-30 years), the potential of landfill biogas energetic utilization will be decreasing.

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