

CREATING VIABLE LANDFILL GAS TO ENERGY PROJECTS IN SOUTH EASTERN – EASTERN EUROPE

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LFG Electricity Projects in Poland

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Overview

- **Description of Instytut Nafty i Gazu (Oil & Gas Institute)**
- **Landfills in Poland – basic data**
- **LFG Electricity Projects in Poland - basic data and cases**
- **Projects realized by Oil & Gas Institute on behalf of GMI**
- **Lessons learned**

Instytut Nafty i Gazu

Oil & Gas Institute



The Institute's research scope comprises all stages of natural gas fuel chain, prospecting for and mining oil, environmental protection and **renewable energy** in particular:

- assessment of exploration prospects in various regions of the country;
- assessment of geological, mineable and industrial deposits of oil and natural gas;
- drilling technology;
- management and mining of natural gas and oil deposits;
- evaluation of plastic materials used in gas industry;
- technical evaluation of gas pipe fittings and gas metering systems;
- evaluation and quality control of hydrocarbon fuels;
- new technologies of gas use;
- **environmental protection issues in the oil and gas industry;**
- **technical assistance in landfill gas capture and utilization (Renewable Energy Technology Department)**



Instytut Nafty i Gazu

Oil & Gas Institute



Renewable Energy Technology Department

- Designs landfill gas capture and utilization systems
- Performs landfill gas modeling and gas pump tests for verification of gas production
- Performs cost assessments of landfill site construction projects and degasification of municipal landfills (pre-feasibility studies)
- Provides technical assistance for operational LFGE projects
- Participates in international landfill gas and biogas project assessments

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Landfills in Poland

- **Number of landfills: 764***

- **Landfills conditions:**

In most cases landfills in Poland are well managed. Most of them have leachate and LFG collection systems.

According to Polish Law every landfill is required to monitor ground water contamination, landfill gas emissions, etc.

Only a small number of unmanaged dumps still exist.

- **Landfill sizes:**

Many landfills but small and medium size. Larger landfills exist only in major urban areas (main cities or capitals of voivodeships)

* source: Annex 1 to National Waste Management Plan 2010

LFG Electricity Projects in Poland

- The most commonly used LFG electricity generation technology is internal combustion engines
- There are only a few installations utilizing cogeneration (heat is sold to end users)
- Most installations are located at large municipal landfills

LFG Electricity Projects in Poland

LFG Electricity Projects in 2002 – 2010

LFG Projects Capacity:

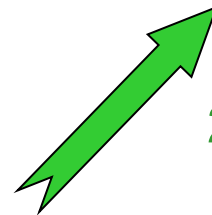
Year 2002* – 15 MW

Year 2003* – 15 MW

Year 2004* – 17 MW

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October 2010# – **44 MW**



250% in 5 years

* source: Obwieszczenie Ministra Gospodarki w sprawie ogłoszenia raportu zawierającego analizę realizacji celów ilościowych i osiągniętych wyników w zakresie wytwarzania energii elektrycznej w odnawialnych źródłach energii (M.P.06.31.343)

source: <http://www.ure.gov.pl/uemapoze/mapa.html>

LFG Electricity Projects in Poland

Possible reasons for increase in LFG energy installations

- Subsidies for construction of a installation (UE resources)
- Energy Certification - availability of “Green Certificates”
- Increased investor interest in landfill gas

LFG Electricity Projects in Poland

Number of projects and capacity

Voivodeship	Project number	Capacity [MW]
dolnośląskie	4	3.595
kujawsko-pomorskie	7	2.818
lubelskie	1	0.500
lubuskie	1	0.500
łódzkie	4	3.336
małopolskie	5	2.938
mazowieckie	17	9.210
podkarpackie	3	1.764
podlaskie	1	0.700
pomorskie	4	2.654
śląskie	14	8.583
świętokrzyskie	1	0.360
warmińsko-mazurskie	2	1.142
wielkopolskie	5	3.624
zachodniopomorskie	8	2.394
Total	77	44.118

Source: Energy Regulatory Office, updated: 30 September 2010

LFG Electricity Projects in Poland

Barycz Landfill, Krakow

Project description:

- Capacity: 1,340 MWe (average output 1,0 MWe)
(249 kWe + 249 kWe + 373 kWe + 469 kWe)
- Pump station output: max 1000 m³/h of LFG
- Average LFG composition:
 - CH₄ 60% [v/v]
 - CO₂ 37% [v/v]
 - O₂ 0,0% [v/v]
 - N₂ 2,85% [v/v]
 - rest 0,15% [v/v] pollutants like (H₂S, CO etc.)

LFG Electricity Projects in Poland

Barycz Landfill



LFG Electricity Projects in Poland

Barycz Landfill



Projects realized by Oil & Gas Institute on behalf of GMI

Grant #1 awarded in 2008:

- Period: September 2008 – September 2009
- Title: “Gas in Poland: energetic capability and awareness of this capability using”

Grant #2 awarded in 2009:

- Period: September 2008 – December 2009
- Title: “Best and Most Effective Technologies of LFG Utilization - Handbook, Training and Capacity Building”

Projects realized by Oil & Gas Institute on behalf of M2M/GMI

Grant #1 awarded in 2008:

Main outputs:

1. Excel Database of Landfills in Poland.
 - 1.1 Landfills data
 - 1.2 LFG emission calculation.
 - 1.3 LFG composition measurements.
2. Internet web site (www.metmarkt.com).
3. Folders, leaflets.
4. One Pre-feasibility study (for selected landfill site).
5. Workshop (at the end of project).

Projects realized by Oil & Gas Institute on behalf of GMI

Grant #1 awarded in 2008:

Main outputs:

1. Excel Database of Landfills in Poland.

Database has been prepared as excel sheet which has been based on existing internet M2M database structure. Data has been collected by specially prepared questionnaire which was sent to the operators and also via phone calls and during the site visits. Data collecting from 73 landfills has been finished by March 2009.

Projects realized by Oil & Gas Institute on behalf of GMI

Grant #1 awarded in 2008:

Main outputs:

4. One Pre-feasibility study (for selected landfill site).

Selected object was Mielec landfill site. This study has been prepared on the basis of data sent by landfill site manager and measurements made on October 2009.

Projects realized by Oil & Gas Institute on behalf of GMI

Grant #2 awarded in 2009:

Main outputs:

1. Capacity building – US landfills visits (8 landfills – different LFGE projects).
2. LFG Technology Handbook
3. Workshop (at the end of project, handbook disseminating).

Projects realized by Oil & Gas Institute on behalf of M2M/GMI

Grant #2 awarded in 2009:

Main outputs:

2. LFG Technology Handbook

Best technologies handbook contains information about technologies used for LFG utilization with examples of existing landfills. It contains guidelines which will help to make the right choice of technology. Following those guidelines, investors will have an opportunity to choose the best and most efficient technology in LFG utilization, thus reducing methane emissions. The Handbook will be available on www.metmarkt.com at the end of December 2010.

Projects realized by Oil & Gas Institute on behalf of M2M/GMI

Lessons learned

- Captured LFG should be sent through a cleaning (treatment) system before use. When raw gas is used, it causes problems in energy installations (CHP units).
- In Poland, most landfills are relatively small. LFG captured from these landfills is low (50 m³/h).
- Most common method of LFG utilization is electricity generation. Waste heat is rarely utilized because of lack of onsite or adjacent thermal demand.

Summary

- Landfill gas in Poland is utilized for energy at larger landfills (electricity generation)
- Small and medium sized landfills typically flare gas without utilization
- Regulatory limit of amount of organic matter in landfills will cause reduction of gas generation
- Landfill gas needs to be minimally treated before use in internal combustion engines
- Improved landfill management will allow landfills with low gas production to still utilize gas for energy projects