LoCaGas

Interreg
South Baltic

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LoCaGas Project
Overview

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Outline of presentation

1. Motivation & background
2. Project objectives
3. Work packages overview
4. Overall structure of the project
5. Deliverables
6. Expected results of the project
7. Project Partners

Motivation & background

Methane as a Greenhouse Gas

Methane emission is an environmental hazard

- Methane has a Global Warming Potential (GWP) of 34 over 100 years (IPCC AR5)
- Atmospheric methane concentration has more than doubled in the past 150 years
- Landfills are the 3rd largest source of anthropogenic methane (16%) after fossil fuel production, distribution, and combustion (33%) and livestock farming (27%)

Why landfills emit methane

- Organic waste decomposes anaerobically in landfills
- This generates landfill gas: ~50% methane, ~50% CO_2
- Methane can migrate and be released into the atmosphere

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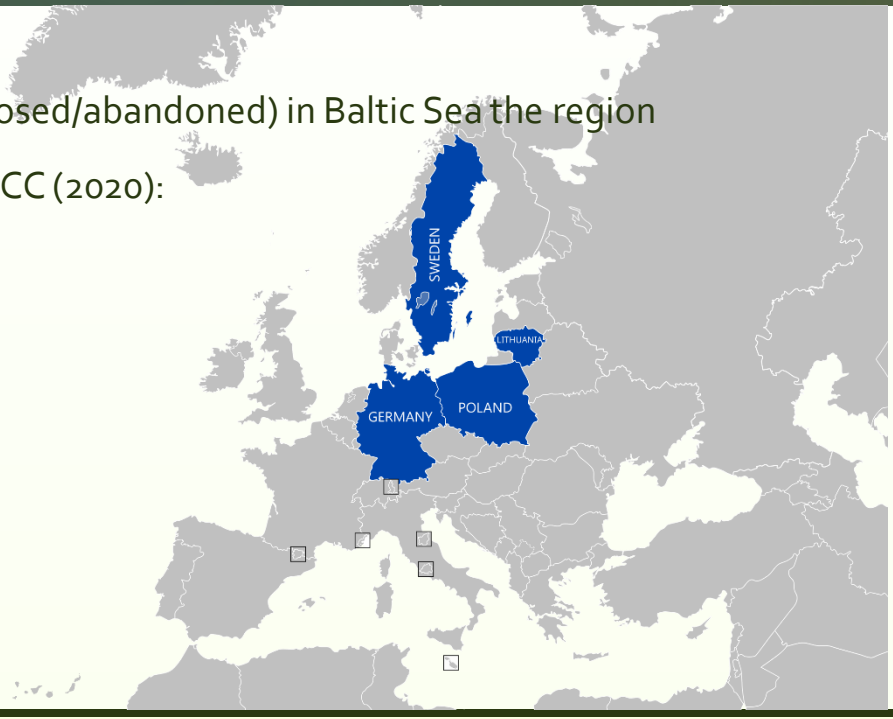
Methane emissions from landfills in the Baltic Sea region

- Up to 100,000 landfills (including closed/abandoned) in Baltic Sea the region
- Emissions (CH_4) according to UNFCCC (2020):
  - Sweden: 782 kt
  - Lithuania: 662 kt
  - Poland: 302 kt
  - Germany: 270 kt
  - Denmark: 21 kt



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Changes in methane levels in landfill gas with increasing landfill age

- Sixteen EU member states have already applied a landfill ban on organic material
- The gas production in landfills declines when no new organic material is landfilled
- The methane level decreases and conventional CHP production using an Otto engine is no longer possible.
- The current procedure is to cover the landfill and install so-called bio-windows

IPCC Guidelines for National Greenhouse Gas Inventories, 2006 – Vol. 5, Chapter 3

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Project objectives

The objective of this project is twofold:

The production of green electricity and heat, which in itself contributes to GHG reduction if the corresponding use of fossil fuels is offset

The reduction of GHG gases by decreasing of spontaneous methane emission from landfills

In addition, transforming indigenous low-quality gas streams into power and heat contributes to the security of supply and diversification of energy systems.

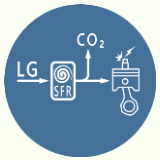
Technologies used in the project for landfill gas utilization for energy purposes

SPARK IGNITION ENGINE WITH OXYGEN-ENRICHED AIR

Use of oxygen-enriched combustion air in a spark-ignited engine to improve combustion quality and efficiency.

DUAL-FUEL ENGINE WITH RENEWABLE PILOT FUEL

Tests with renewable pilot fuels in a dual-fuel engine for efficient power production and reduction of GHG emissions.



SPINNING FLUIDS REACTOR (SFR) FOR CO_2 REMOVAL

Application of SFR technology to separate CO_2, increase the methane content, and improve the heating value of the landfill gas

Spark ignition engine with oxygen-enriched air

Spark ignition engines fueled by landfill gas often face challenges due to its low methane content and high levels of inert gases. To improve combustion efficiency and engine stability, oxygen-enriched air can be introduced.

Key benefits of using oxygen-enriched air include:

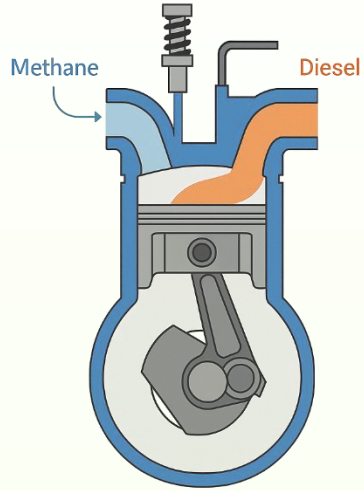
- Enhanced ignition and flame propagation,
- More stable operation with low-quality biogas,
- Higher thermal efficiency and reduced unburned hydrocarbons,
- Potential for smaller engine sizes at equivalent power output.

This technology allows for the utilization of biogas that would otherwise be unsuitable for conventional spark ignition systems.

DUAL-FUEL ENGINE WITH RENEWABLE PILOT FUEL

Key benefits of using dual-fuel engine:

- Operates on a mixture of pilot fuel and landfill methane
- Enables energy recovery from low-quality landfill gas
- Reduces greenhouse gas emissions compared to flaring
- Improves fuel flexibility



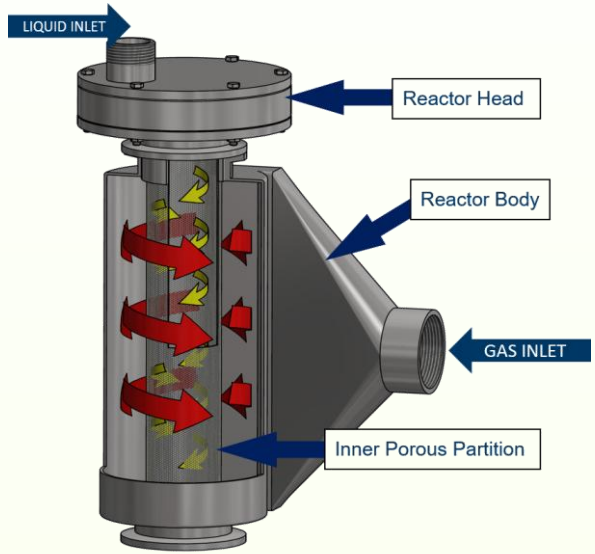
A dual-fuel engine is a type of internal combustion engine that operates using two types of fuel simultaneously — typically a gaseous fuel (such as landfill biogas) and a liquid pilot fuel, usually diesel.

Spinning Fluids Reactor (SFR)

The Spinning Fluids Reactor (SFR) is an innovative device designed to enhance gas–liquid mass transfer by utilizing the dynamics of counter-rotating fluid layers inside (liquid) and outside (gas) a porous cylinder..

The reactor offers a compact and scalable solution for intensified processing in chemical and environmental applications.

In the LoCaGas project, SFR will be used to increase the methane content in landfill gas by removing part of the CO_2. The enriched landfill gas, with a methane content of up to 50%, will then be utilized in standard generators



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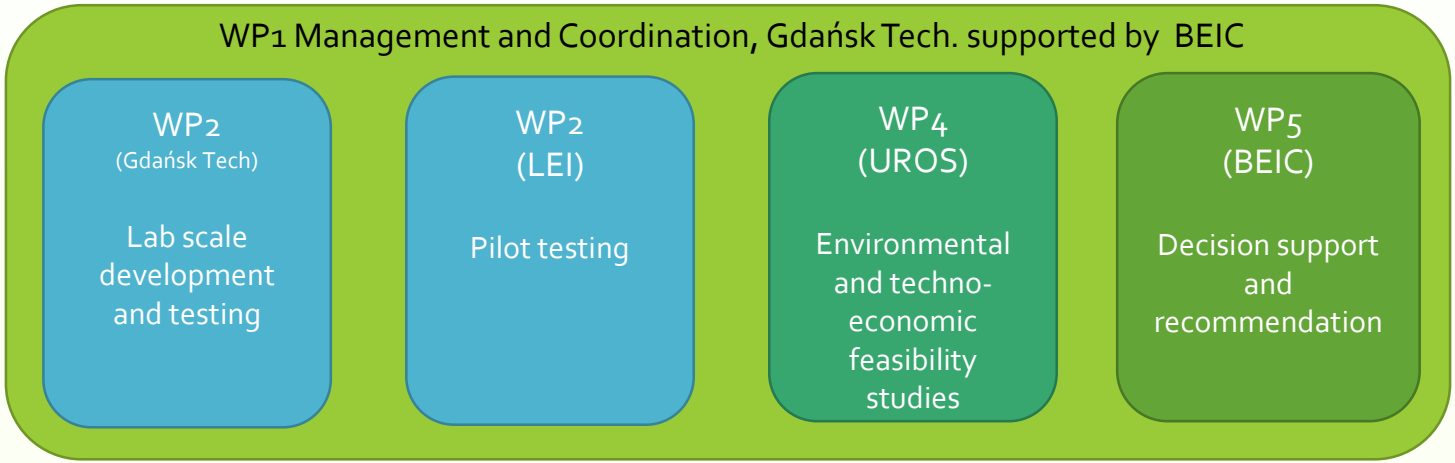
Overall structure of the project

Programme measure: 2.1 Supporting transition towards green energy



Output 1
A decision-making tool for selecting the method of utilising landfill gas with low methane content.

Output 2
Pilot-scale evaluation of low-calorific landfill gas utilisation technologies.

Output 3
Recommendations for the use of the technologies investigated for green energy production, based on three solutions developed within the project.

Project deliverables

WP2

- Joint report on the development of research procedures and technical documentation of laboratory installations
- Report on research results at lab scale on the utilisation of artificial low-calorific landfill gas for the production of green energy
- Jointly developed comparison report of the tested installations at lab scale

WP3

- Report on the pilot implementation of installations for the utilisation of low-calorific landfill gas
- Report on research results on the utilisation of low-calorific landfill gas for green energy production in a pilot installation
- Report on mathematical models of a low-calorific landfill gas utilisation installation

Project deliverables

WP4

- Report on ex-ante evaluation of the technical concept for technologies investigated in WP2 and WP3
- Reports on sustainability assessment of technologies investigated in WP2 and WP3

WP5

- Report on the utilisation of investigated technologies for the production of green energy
- Joint report on case studies on landfill gas utilisation using investigated technologies

Project Partners

- Gdansk University of Technology (Poland), Lead Partner
- Baltic Energy Innovation Centre (Sweden)
- Eco-Construction Ltd. (Poland)
- Klaipeda University (Lithuania)
- Lithuanian Energy Institute (Lithuania)
- NSR AB (Sweden)
- UAB Addeco (Lithuania)
- University of Rostock (Germany)

Project Associate Partners

- Energy Agency Southern Sweden (Sweden)
- European Biogas Association
- German RETech Partnership e.V. (Germany)
- Waste Treatments Plant Nowy Dwor (Poland)
- Deponigas ApS (Denmark)
- UAB „VAATC" (Lithuania)
- Swedish Waste Management Association (Sweden)
- JSC Alytus Region Waste Management Center (Lithuania)
- The Kaunas Region Waste Management Center (Lithuania)

Project in the numbers

- Total project budget: 1,786,200 EUR
- ERDF co-financing: 1,428,960 EUR
- Own contribution: 357 240 EUR
- Start of the project: 1.07.2024
- Planned project completion: 30.06.2027
- Project duration: 36 months
- Number of conferences: 3
- Countries in partnership: Poland Sweden Lithuania Germany

Project conferences

Three project conferences are planned:

1. The current one, taking place on 26 June 2025 in Helsingborg, Sweden
2. One planned for June 2025 in Lithuania
3. One planned for May 2027, which will be held in Gdańsk, Poland

You are already warmly invited to the upcoming conferences!

LOW CALORIFIC GAS FOR GREEN POWER PRODUCTION

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THANK YOU FOR ATTENTION

Do you have any question?

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