

Feasibility study for Lviv Municipal Wastewater Treatment Plant sludge utilisation and regional farms biogas production potential

Project background

Name of applicant	Lviv Regional Administration
Project info/Project name	Feasibility study for Lviv Municipal Wastewater Treatment Plant sludge utilisation and regional farms biogas production potential
Contractor	AFRY
Project duration	January–December 2021
Contract value	EUR 95,000

Project summary

1 Project summary

The aim and purpose of the project was to gather information on the current status and capacity of wastewater treatment plants (WWTP) in the Lviv region and to identify the potential of using sludge from the wastewater treatment plants for energy generation. The options considered were biogas production, composting and incineration. An additional project target was to select 2 pilot WWTPs for energy generation using sludge.

There are 50 WWTPs in the Lviv region. Of these, 18 were analysed in the study and 10 were selected for site visits to assess their actual environmental and technical conditions.

2 Project conclusions

It was found that most of the plants are old (commissioned mostly in the 1960s and 70s), outdated, have not been properly maintained and require at least partial reconstruction and replacement of critical equipment. Many of the plants discharge more or less treated wastewater to the River Bug or its tributaries. The River Bug eventually connects to River Vistula, which discharges to the Baltic Sea. Consequently, wastewater from the Lviv region is ultimately loading the Baltic Sea ecosystem.

Two pilot projects were selected based on their capacity and readiness for energy conversion: Drohobych WWTP and Chervonohrad WWTP.

The estimated biogas production potential at **Chervonohrad WWTP** is approximately 700 m³CH₄/day, given an average sludge volume of 60.3 m³/day, which is sufficient for running a **120 kWe** CHP. Yearly net electricity production is estimated at about 0.880 mln kWh, which could cover nearly the entire electricity demand by the WWTP. GHG emissions reductions are calculated at 138 tons CH₄/year, which is equivalent to almost 2,900 tCO₂eq/year for a time horizon of 100 years.

The estimated biogas production potential at **Drohobych WWTP** is approximately 880 m³CH₄/day, given an average sludge volume of 60.6 m³/day, which is sufficient for running a **150 kWe** CHP. Yearly net electricity production is estimated at nearly 1.09 mln kWh, which could cover at least half of the recent electricity demand by the WWTP. The net heat production is 0.92 mln kWh. Production of the solid fraction of digestate after separation is estimated at 3,224 tons a year. GHG emissions reductions are calculated at 151 tons CH₄/year, which is equivalent to almost 3,170 tCO₂eq/year for a time horizon of 100 years.

Both biogas plants are at the same level of capacity, which is not sufficient to

make them viable private investments (the electricity tariff would need to be at least 0.38-0.48 euro/kWh, which is unlikely to occur in the near future). The solution is to construct a biogas plant as part of a communal WWTP that incorporates proper handling of sludge, thus avoiding environmental pollution. A financial analysis concluded that the project would be viable, given the total electricity consumption by the WWTP at current tariffs, even with a slight increase in the wastewater tariff.

3 Impact on Human Rights and the project's Sustainable Development Goals (SDGs)

WWTP sanitation and water protection are closely related to SDG 6 'Clean water and Sanitation', aimed at the protection of human and environmental health through the reuse of extracted materials such as wastewater, and SDG 12 'Responsible consumption and production' aimed at ensuring sustainable and responsible consumption of water as the most precious resource.

The introduction of a biogas system in the energy and waste management value chain has a positive impact on SDG 7 'Affordable and Clean Energy' and SDG 13 'Climate Action' by increasing access to affordable and clean energy. Biogas is a clean source of energy and its introduction has positive environmental impacts by reducing demand for traditional black carbon-based fuels, such as traditional biomass and fossil fuels. Biogas positively impacts the climate through reduced GHG emissions and reduction of sludge dumping to landfills.



4 Project deviations

No project deviations were identified. Some minor delays in project deliverables occurred.

5 Project lessons learnt

Lessons learnt

The majority of WWTPs are old, outdated, have not been properly maintained and require reconstruction and the replacement of critical equipment; thus, when planning to use sludge for energy generation the choice of site has to be selected carefully, taking into account the readiness of the WWTPs for a biogas plant.

However, biogas plants should be considered as a part of the communal WWTP, providing proper sludge handling and thus avoiding environmental pollution, not as a separate unit or facility. The project can be financially viable through the increase of wastewater tariffs, as the green electricity mechanism is not feasible.

Benefits of the project

The project improved cooperation between Finnish and Ukrainian experts on the important topic of converting WWTP sludge into biogas. The project contributed to the following FUTF targets:

- Consultation on policy: The FS covered the importance of sludge management at the WWTPs and energy generation from the biological WWTP waste, summarised the regulation of WWTPs by a significant number of legislative acts and instructions, and highlighted legislative gaps for biogas project development related to unfavourable mechanics and how these impact operations.

- New technology introduction: The FS considered options for energy generation from sludge such as biogas production, composting and incineration applying EU standards.

Based on the FS, Lviv can develop a strategic plan for developing WWTPs (composting for smaller plants if applicable and biogas technology for larger plants).

- Training and transfer of expertise: The project ensured the transfer and sharing of knowledge and experience in the fields of sludge management and biogas, organised workshops, and demonstrated how international funds are looking at potential investment projects and how to prioritise and develop a long-term strategy for WWTPs conversion.

- Finnish content: Finland has extensive experience in WWTPs, energy generation from sludge and biogas facilities. The Lviv administration conducted a number of consultations on effective methods of implementing biogas projects in Ukraine.

The project also improved Finnish experts' understanding of the market conditions in Ukraine and increased access to new resources and opportunities for further cooperation.

Effectiveness of the project

The project was implemented successfully and delivered on the FS targets, as well as the FUTF objectives to promote cooperation between Finland and Ukraine and identify opportunities for future projects. The Lviv administration assessed the applicability of biogas technology for all WWTPs, and based on the FS can now develop long- and short-term WWTP strategy plans for the green economy. The project results are replicable, as every large Ukrainian city has WWTPs of a similar size, and thus the technological solutions analysed in this report, financial viability and calculations as well as overall conclusions could be applied to strategy reviews of other WWTPs in Ukraine.