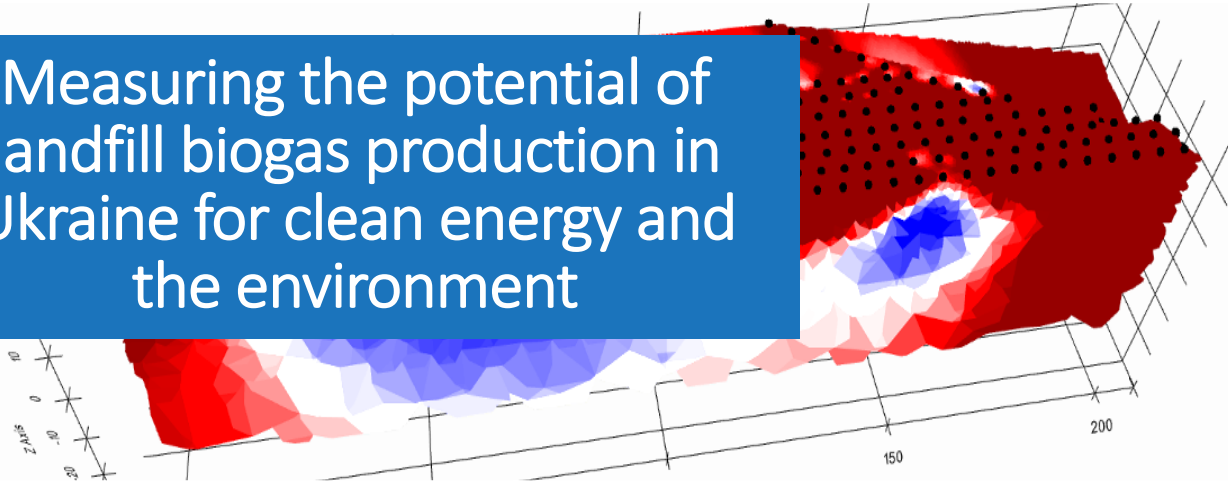




Measuring the potential of landfill biogas production in Ukraine for clean energy and the environment



DEEP SCAN TECH – LOCATING BIOGAS SOURCES IN LANDFILLS

The unique underground 3D scanning technology of Deep Scan Tech was applied in a pilot project in Ukraine to help develop the country's domestic biogas production from landfills. Biogas can help countries improve their energy independence in an economically sustainable way while also protecting the environment. In fact, landfill gas recovery represents the most cost-efficient technology available for biogas production, according to an estimate by the International Energy Agency (IEA), with an average cost of 0.8 cents/kWh. This is less than a third of the typical price of Ukrainian natural gas over recent years. Moreover, there is an additional environmental benefit: not only is landfill gas a renewable energy source, but using it also reduces fugitive emissions of methane – a potent greenhouse gas with a global warming potential 84 times greater than that of carbon dioxide¹.

Deep Scan Tech is helping to solve a major problem in searching for landfill gas sources. Until now, there has been no reliable way to know where the most productive areas for biogas are located within landfills.

“Landfills represent a highly profitable potential source of biogas – if you know where to drill for it.”

The current standard approach is to drill wells around the landfill and measure gas outflows in different areas. However, sampling in this manner can result in hitting a hotspot of biogas production, missing it entirely or anything in between. This can directly impact decisions on investing in biogas production, as sampling results might indicate that a potential project will not be profitable over time.

Landfills are the third largest source of fugitive methane emissions globally. Responsible landfill operators aim to limit their methane emissions to reduce their carbon footprint, and biogas production offers them a profitable way to achieve those goals.

Using 3D scans of the internal layers and volumes of the landfill conducted from the surface, Deep Scan Tech is able to locate areas of high humidity and organic content, which are the two essential conditions for biogas formation. Armed with this key information, exploration for biogas can be targeted at the most productive areas.

POTENTIAL APPLICATIONS IN UKRAINE

- ▶ Other Potential applications for 3D scanning technology range from feasibility studies and the development of new landfill gas plants to optimising the operation of existing plants, e.g., through the irrigation of landfill heaps.
- ▶ Environmental protections can be planned based on a better understanding of actual conditions beneath the surface.
- ▶ 3D scanning can help with repurposing land for construction and other development. Old landfills, other buried waste and contaminated land can be scanned to support planning. This can mean, for example, more precise delineation of areas with polluted soil for more efficient removal.
- ▶ In Ukraine, we recommend the use of scanning to explore medium-sized landfills that are not yet used to collect methane and potentially for monitoring landfills with existing systems to secure and optimise their operation.

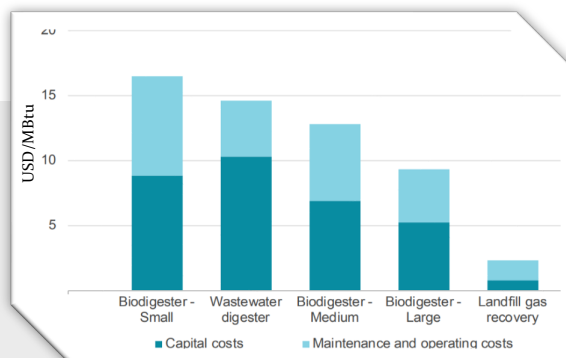
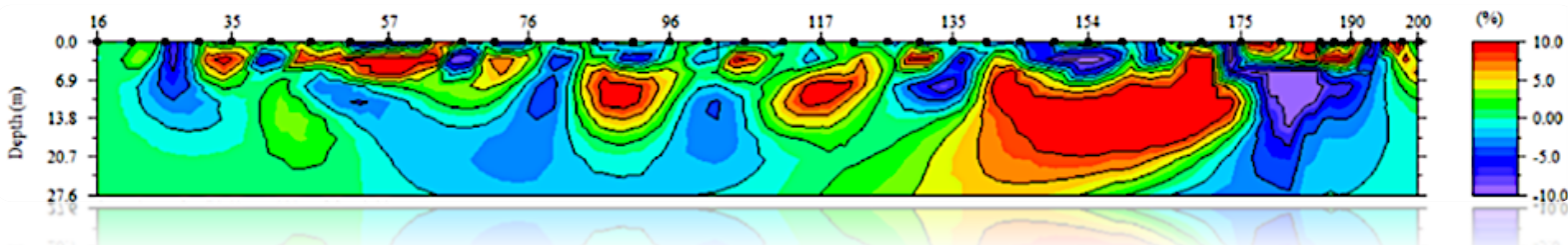


Figure 1. The IEA Outlook for Biogas and Biomethane from 2020 estimates that landfill gas is most cost-efficient among the various sources of biogas.

¹ UN Economic Council for Europe: <https://unece.org/challenge>



DEEP SCAN TECH – A UNIQUE 3D SCANNING SOLUTION

Deep Scan Tech is a Finnish clean tech company providing an unprecedented 3D view of what is under the ground effortlessly from the surface. Its technology allows landfills to be scanned to see what lies beneath and answer questions such as: Where is landfill gas being formed? What can be done to improve landfill gas production? Where are the potential sources of environmental problems and what can we do to prevent them?

- ▶ Non-invasive: No need to drill or break structures with measurements taken from the surface
- ▶ 3D Visibility: Create images of internal structures, materials, soil types and moisture
- ▶ Quick and easy: Scan large areas quickly, reliably and within budget

PROJECT BACKGROUND

3D scans were conducted at the landfill in Melitopol in 2021, a city of 150 000 inhabitants. The project was financed by the Finland Ukraine Trust Fund, which provides grant financing to promote cooperation in the fields of energy efficiency, renewable energy and alternative energy sources for power, heat generation and district heating networks. The Fund is financed by the Ministry for Foreign Affairs of Finland and managed by Nefco. The local coordinator is the State Agency on Energy Efficiency and Energy Saving of Ukraine (SAEE). For more information, see www.nefco.org/finland-ukraine.

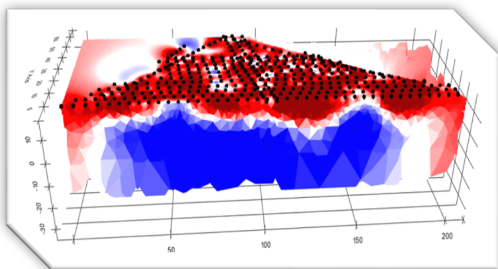


Figure 2. An example of a 3D view of landfill content shown to a depth of 30 metres. The blue colour indicates low resistivity, typically associated with high moisture content. Black dots indicate measurement points on the surface.

Figure 3. (at the top of the page) An example of a cross-section of landfill contents shown to a depth of 27.6 metres. The red colour indicates conditions likely to be associated with hotspots for landfill gas production.

PROJECT SUMMARY

- ▶ This project demonstrated the use of a novel 3D scanning technology, applied from the surface, for locating potential hotspots for landfill gas production.
- ▶ The scans revealed the presence of organic material and moisture, both necessary conditions for biogas production, that provided a strong indication of the landfill gas potential at Melitopol landfill.
- ▶ The results indicate that these non-invasive 3D scans can be applied quickly to produce useful images of landfill content for the purposes of landfill gas exploration.
- ▶ At functioning landfill gas production sites, similar 3D scans can be used to optimise production, e.g., with moisture control. By detecting the conditions within the landfill at precise locations, targeted measurements can be taken to increase landfill gas production. The measuring equipment can easily be left in place for long-term monitoring given that the electrical wires and electrodes used are affordable and durable.

PROJECT FINDINGS

- ▶ The measurements conducted in Ukraine were successful in showing where likely areas of biogas production were located within the landfill.
- ▶ Measurements were taken in a matter of a few days and without the need for digging or heavy equipment.
- ▶ The produced scans covered the total depth of the landfill heap of 40 metres.
- ▶ The results show promising potential for biodegradable material if the scanned areas are representative of the whole landfill. About 40% of the scanned area contains potential biodegradable material in amounts that could be described as significant, and a systematic application of the scanned images could be used for drilling test wells at likely hotspots for gas generation.
- ▶ The comprehensiveness and value of the results is greater than with alternative methods, while the cost of the measurements is small.

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Non-invasive 3D scanning for securing
clean and resilient environment

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