

Advancing Landfill Gas Recovery and Utilization for Renewable Methane Production

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Introduction and aim

- Finland's climate targets require additional emission reductions in sectors like waste management, as legacy landfill waste continues to emit methane decades after disposal despite improved waste handling practices.
- Landfills remain a significant methane source due to large amounts of biodegradable waste deposited before the 2016 landfill ban, making efficient landfill gas (LFG) capture and utilization essential.
- Although LFG can reduce emissions and provide renewable energy, its use is limited by fragmented expertise, declining methane content, and technical challenges such as hydrogen sulfide and other impurities and upgrading costs.
- The KAJASTUS project responds by advancing measurement and control tools, piloting improved gas recovery solutions, and fostering national knowledge sharing to turn landfill gas from an environmental challenge into a clean energy opportunity.
- Learn more: circhubs.fi/en/kajastus-2/

Practical pilots to enhance LFG quality

Pilot results showed that moisture management via irrigation can significantly enhance methane generation, especially when adapted to weather conditions, landfill age, and uniform application.

Cover-based gas capture and hydrolysis gas injection demonstrated potential to reduce fugitive emissions and odors and improve overall gas recovery, though methane concentration gains were limited and permitting and operational complexity must be addressed.

Operational practices, particularly a well-planned maintenance calendar for pumping stations and the use of automated valve controls, were identified as critical for sustaining performance and minimizing downtime.

Overall, the findings highlight that maximizing landfill gas recovery requires combining technical innovations with practical, site-specific operational strategies, while managing challenges such as high sulfur and nitrogen content.

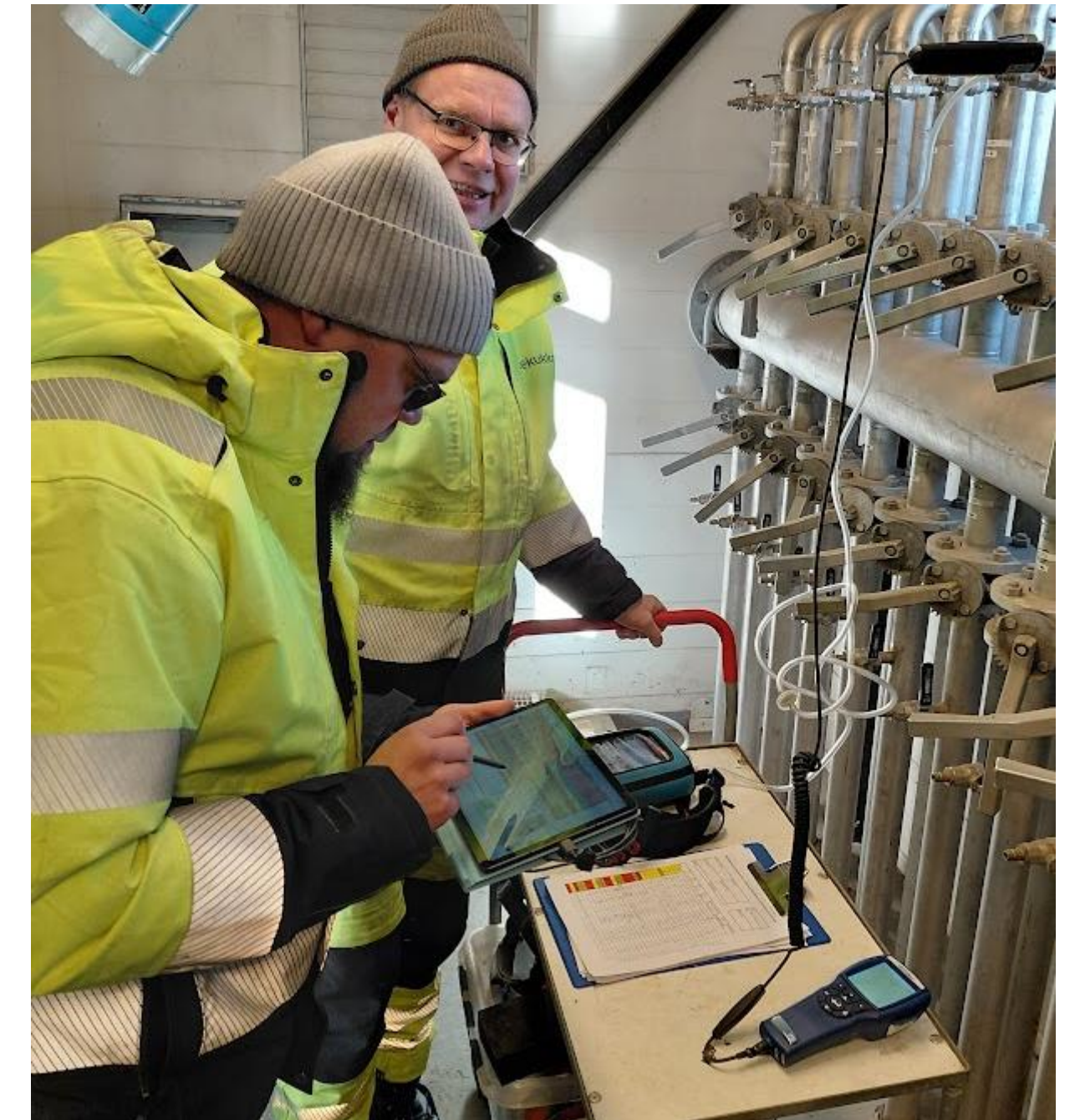


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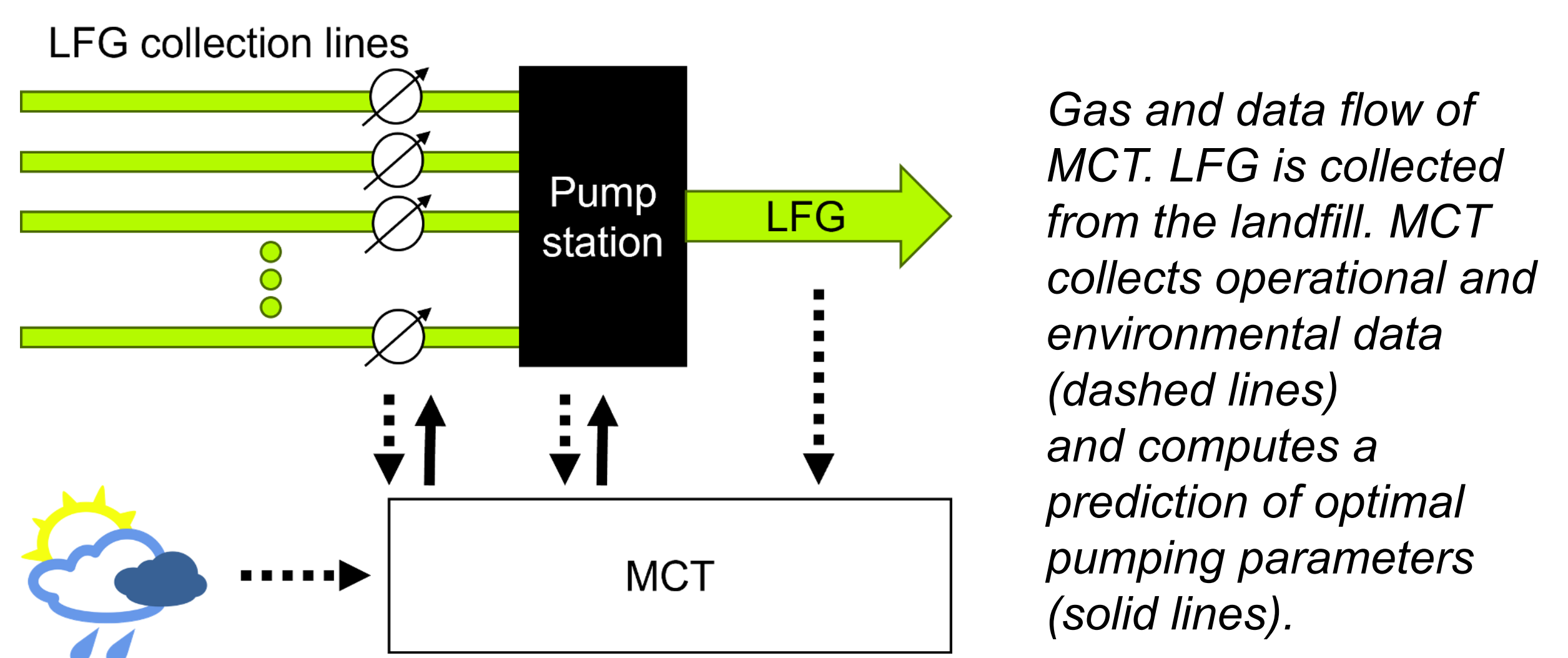
MCT aims to digitize measurement data note taking and processing. This facilitates using computational modeling to further optimize the LFG collection and also to collect and transfer expertise of landfill operators.

Poster presenter Jari Heikkinen (jari.heikkinen@jatekuukko.fi) in the background.



Measurement and control tool (MCT)

The KAJASTUS project develops a Measurement and Control Tool (MCT) that optimizes landfill gas recovery at pumping stations by combining standardized measurements with predictive software. The MCT uses data-based modelling that accounts for multiple operational variables and differences in measurement practices between landfill sites. Its main purpose is to support operators in achieving stable gas flow rates with the desired methane concentration. At minimum, the MCT uses gas flow and methane measurements and enhances them with historical data, gas composition, pump parameters, and weather information to infer optimal operating conditions. MCT source code will be released after the KAJASTUS project.



National working group

In addition to technical outcomes, KAJASTUS fosters collaboration among waste management companies and research institutions, creating a national working group of specialists and knowledge network. Furthermore, annual maintenance calendar and training protocol to be developed in the project will highlight the importance of systematic operations. The project's technology roadmaps and best practices will guide future investments and support compliance with the EU Renewable Energy Directive (RED III) as well as give tools and advice to landfill operators.