BRAZIL, RIO DE JANEIRO

POPULATION
6.6 million

Organic Waste to Biogas in Rio de Janeiro's Biomethanisation Unit

With a population of approximately 6.6 million inhabitants, Rio de Janeiro stands as the second-largest city in Brazil and the third-largest metropolitan area in South America. Around 22% of its residents inhabit informal settlements. Annually, Rio produces roughly 3.5 million metric tons of solid waste, with organic matter constituting approximately 27% of the total waste stream. Household waste is roughly composed of 50% organic matter. Despite the implementation of recycling initiatives and a centralized composting plant, Rio's recycling rate remains disappointingly low. Moreover, the composting program grapples with the daunting task of converting low-quality organic waste into usable compost, presenting formidable challenges to waste management efforts in the city.

In a collaboration involving Methanum Company, the Federal University of Minas Gerais (UFMG), and the Municipal Urban Cleaning Company of Rio de Janeiro (Comlurb), a pioneering technology has been developed in Brazil and Latin America. Known as the "Biomethanisation Unit" this innovative system processes the organic fraction of municipal solid waste using solid-state batch anaerobic digestion with leachate recirculation. The primary goal of this biological system is to determine optimal operational parameters and introduce a novel business model for managing organic waste in Brazil. By doing so, it aims to convert organic waste into renewable energy and compost, thereby diverting it from landfills.

With an annual processing capacity of about 3,000 tons, the Biomethanisation Unit can handle organic waste equivalent to that produced by a city with over 15,000 inhabitants. This organic waste encompasses food waste from major sources like municipal schools, supermarkets, and restaurants, as well as pruning waste from green areas, serving as a vital carbon source and bulking material for the biomethanisation process.

The "Biomethanisation Unit" strongly supports a key objective outlined in the Rio de Janeiro City Hall Strategic Plan (2021-2024): to minimize the final disposal of solid waste in landfills. This initiative underscores the importance of recovering and valorizing the organic fraction, aligning with the city's commitment to adopt a zero-waste governance approach.

Source: Methanum

IMPACTS TO ACHIEVE SDG 11.6.1

- The processing of organic waste yields over 300 tons of organic compost annually, contributing to Rio de Janeiro City's urban agriculture and reforestation initiatives.
- The biogas generated is converted into both electrical and thermal energy, ensuring the methanization system's energy self-sufficiency, with any surplus energy being fed into the electrical grid. As a result of the methanization process, there is a notable reduction of approximately 40% in the total waste mass, leading to decreased transportation, landfill, and leachate treatment expenses.
- Operating with a biogas yield of approximately 70 Nm^3 per ton of organic waste, this process efficiently converts waste into energy. The generated biogas is harnessed to produce electrical energy, thereby ensuring the self-sufficiency of the treatment process.
- By diverting approximately 3,000 tonnes of organic waste from landfills annually, it effectively mitigates the emission of approximately 3.4 MtCO2e each year (avoiding GHG from fugitive methane emissions in landfills and the reduction of waste transfer by fossil fuel trucks).
- The use of compost also promotes 'soil carbon sequestration,' fosters biodiversity, and enhances food security within the city. This approach not only supports a circular economy but also bolsters community resilience and food security.

Pipeline transporting gas to be transformed into electricity

Equipment measuring the quality of gas being produced

Source: dw.com

INSTITUTIONAL SUSTAINABILITY

The waste-to-energy technology, is a product of collaborative efforts between the Federal University of Minas Gerais (UFMG), Methanum Tecnologia Ambiental, and Comlurb companies. Implemented and overseen at a processing plant operated by Comlurb, the City Company of Urban Cleaning, situated in the Caju neighborhood, the technology underscores a commitment to sustainable practices within the institutional framework. Operation of the pilot plant, which was funded by BNDES (National Bank for Economic and Social Development), will allow testing the efficiency of the methanization technology by anaerobic composting and widening the scale.

PLANNING & MONITORING

The pilot project initiated in December 2018 by Comlurb. After just one month of operation, monitoring revealed that the facility processing approximately 30 tonnes of organic waste daily, yielded impressive results, extracting 100 to 150 cubic meters of biogas per ton of feedstock processed, with a methane concentration of 50 to 60 percent. Comlurb's existing conventional composting plant, featuring in situ aerobic digestion, provides a valuable point of comparison for evaluating the efficacy of the new technology. The Company's Applied Research Center is conducting thorough laboratory analyses of all materials and overseeing the monitoring process.

APPROPRIATE TECHNOLOGY

- Capacity: 35 tons of waste per day, in a structure made up of seven tunnels.
- The facility consists of modules that are approximately the same size as a shipping container. These modules receive waste and are sealed for two to three weeks. Bacteria introduced into the compartment via a spray system degrade organic matter and produce methane. The resulting biogas is stored while the remaining material is removed and used as fertilizer.
- The plant has an estimated monthly biogas production capable of feeding a fleet of 1,000 cars or generating enough energy for just over a thousand houses
- Technology developed is suitable for large and medium-sized cities.

Filling of methanization tunnels

Source: Methanum

Source: recycling-magazine.com

STAKEHOLDER INVOLVEMENT

The waste-to-energy project in Caju involves various stakeholders dedicated to sustainable waste management. Leading the effort is Comlurb, overseeing project implementation. UFMG collaborates closely, bringing research expertise to drive technological advancements. Partnering with UFMG, Methanum Tecnologia Ambiental is offering innovative solutions. Funding from BNDES supports financial sustainability. Local authorities ensure regulatory compliance, while the community provides essential feedback and support. Together, these stakeholders form a collaborative network focused on environmental stewardship and community resilience in waste management.

SOURCES

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