

Biogas as an alternative source of decentralized bioelectricity for large waste producers: An assessment framework at the University of São Paulo

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Abstract

Decentralized power plants fueled with biogas from organic waste are a keystone for large waste producers responsible for their waste management to reduce the impact of waste generation and poor management, especially in the urban centers, alongside bioenergy and other value-added products generation. This work presents an assessment framework for the characterization quantification and assessment of the biogas potential using theoretical and lab-scale methodologies to evaluate the technical and economic bioelectricity potential from biogas using the organic residues and effluents produced in the main USP campus. The yearly costs to transport and dispose of these residues are around US\$ 3,253,716.25, and the electricity consumption is about 8.6 million US\$/y. As a large generator, USP is responsible for its residue management, and reduce its generation by the local use to produce bioelectricity is a feasible option. The results show a biogas potential up to 2,363,405.15 m³, allowing for a bioelectricity generation of up to 4454 MWh/y. A potential to produce 3081.131 tones of dry biofertilizer was also estimated. The wasted resource could currently supply up to 5.6% of the Campus's electricity demand, with an investment of around US\$ 1.5 million and a payback range between 3.64 and 7.5 years.

Keywords : Biogas; Food waste; Pruning residues; Sewage; Bioelectricity; Waste-to-energy