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“Bridging the gap between increasing knowledge and decreasing resources”

## Potential of Large-Scale Biogas Production in Urban Areas: A Case Study in Moshi, Tanzania

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### Abstract

Moshi is the capital of the Kilimanjaro Region of Tanzania. Moshi's economy is strongly dependent on its natural resources, especially Mount Kilimanjaro and the surrounding area. Solid waste management is a serious problem in Moshi. The landfill will soon reach its capacity and yet there is no solution for a new system.

The aim of this case study was to research the potential biogas production from organic waste, on a municipal scale. Contrary to conventional biogas production in Tanzania on a small-scale household level, a novel approach for urban biogas production was developed. The goal is to decrease the amount of solid waste dumped at the landfill while simultaneously introducing a clean bioenergy system.

In this study it was determined that 13,658 t a<sup>-1</sup> solid waste with an organic share of 66.5%, and 3,754 t a<sup>-1</sup> residues would be available in Moshi. The chemical composition of several samples and their specific biogas and methane yields were later measured in the laboratory at the University of Hohenheim, Germany.

Depending on which substrates are used, a daily maximum energy production of 11,654 kWh<sup>-1</sup> to 16,051 kWh<sup>-1</sup> would be possible. Based on a hydraulic retention time of 40 days, the digesters would need a dimension of 1,978 m<sup>3</sup> or 1,614 m<sup>3</sup>. The results show that the respective digester volume is 164 times bigger compared to a state of the art household digester with a size of 12 m<sup>3</sup>, mostly used in rural areas. Yet such technology is not standard in Tanzania. This implies that process technology and process biology need to be addressed in further studies.

Interviews of potential biogas users showed that the energy demand is even higher than the maximum potential biogas production.

A separation of the organic waste would significantly decrease the waste volume, as well as emissions and ignitions at the landfill, and offer a valuable resource that could be recycled. An important next step for the project is to establish a pilot plant to review the concept.

**Keywords:** Bioenergy, biogas, recycling, solid waste management, Tanzania, urban area