Biogenic Waste to Energy Case Study- a strive for Energy Autonomy

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Abstract

The Energy Autonomous Campus program is aimed at making the CSIR Pretoria campus energy autonomous over a 5- to 8-year period by supplying its energy from the three primary energy sources – solar, wind and biogas. This platform will be used to demonstrate, in a real-world setting of significant size, a future energy system that is based on a combination of fluctuating and dispatchable renewables that can be designed and operated in the most cost-efficient manner.

Figures from the World Bank (2016) indicates that South Africa is the 15th highest producer of waste in the world. According to (Godfrey *et al*., 2014) South African waste sector survey results showed that landfilling remains the main technology option for management of waste, with 90% of all waste generated disposed to landfills. Currently South Africa's landfills are rapidly running out of space however policy and regulatory reforms, environmental pressure and increased sustainability awareness are changing the waste landscape. Estimates from Department of Environmental Affairs (2012) showed that only 10% of waste is recycled, therefore there is substantial room for industries to come up with solutions to reduce the amount of waste sent to landfills that can create a sustainable environment.

One main focus of the Energy Autonomous Campus program is to establish a biogas plant that utilises biogenic waste for power generation. The biogas plant will provide a dispatchable electricity generation when solar and wind energy are not available. The plant will also make use of Combined Cooling, Heating and Power (CCHP) which will allow for increased efficiency. The security of feedstock supply is key in the success of the waste to energy project. The feedstock is expected to be 100% organic in both dry and liquid form. Three potential sites have been identified within the CSIR Pretoria campus for the location of the plant. To limit the cost of transporting waste to the biogas site, a virtual boundary of feedstock collection with a radius of 50km is considered. However, this boundary was not deemed to be prescriptive, meaning if a significant source of organic waste is identified slightly beyond this boundary, it would also be considered.

In order to mitigate negative impacts of biogas facility on the ecosystem, the selection of right technology is important. A feedstock study showed that a total of 49 tons of food waste could be sourced from the nearby areas daily. The biogas feedstock can be improved by co-digestion of sewage sludge and abattoir waste resulting in 0.5MW electrical capacity and 0.56 MW cooling and/or heating capacity. The feasibility study and technical design will determine the viability of the proposed project by providing a high-level business model. This model considers different ways to maximize outputs from biogas waste plant such as electricity, heat, organic fertilizer etc.

This presentation will focus on a holistic approach of generating energy from waste for the CSIR, contributing to the reduction of greenhouse gases, waste in landfills and production of electricity as well as useful by-products and determining viability of the business case.

Keywords
Energy Autonomous, Biogas, Waste to energy, Case study

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