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Green economic development in the city of Johannesburg: Production of biogas to fuel city buses

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The City of Johannesburg has explored the opportunity of using biogas to fuel its buses in the drive to be low-carbon, resource efficient and socially inclusive. This study explored the feasibility of using biogas to fuel buses in the city of Johannesburg, South Africa. Biogas is a renewable fuel that can be used for electrical power, heating/cooling, and as a transport fuel. However, the use of biogas for transportation delivers more financial value-adding compared to using biogas for electricity- US$18/GJ for transport fuel and US$9/GJ for electricity. In addition, the use of biogas to fuel city buses has additional local benefits; such as reducing air pollution from vehicle tail-pipe emissions, reducing traffic congestion, and enhancing the social inclusivity of transportation. The cultivation of land and use of energy crops as feedstock for biogas production will require at least seven hectares per bus; which will place additional demands on the city's scarce land resources and create potential conflicts with food production. Biodegradable wastes are alternative feedstock for biogas production that avoids these impacts and can be supplied at a cost that is currently competitive with the price of other transport fuels, such as diesel and petrol. However, the feasibility depends on the combined economies of scale for biogas production, upgrading and distribution; such that large-scale biogas production (>2000 Nm^3/h) is required to compete with petrol and diesel market prices. Using size-location modelling, we identified the optimal locations for two large biogas facilities that use the organic fraction of municipal solid waste as feedstock to produce upgraded biogas that can fuel up to six-hundred city buses. The benefits of this project include diverting organic waste from landfill, reducing carbon emissions, improving local air quality, increasing transportation efficiency, delivering new opportunities for transit orientated development and facilitating the transition to a Green economy.

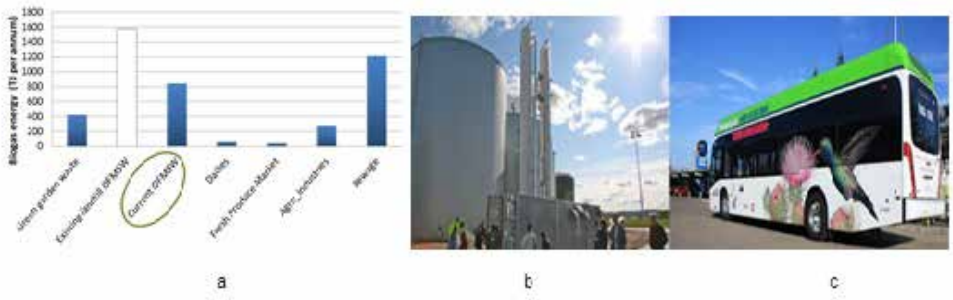

Figure 1: Production of Biogas from the organic fraction of municipal solid waste (OFMSW) to fuel City of Johannesburg buses. (a) Availability of organic wastes in the City of Johannesburg Metropolitan Municipality. (b) Biogas production and upgrading plant. (c) City of Johannesburg buses capable of running on upgraded biogas (bio-methane).

Biography

William H L Stafford is a Life Scientist with R&D experience spanning 20 years. His research encompasses diverse fields of Biochemistry, Biotechnology, Microbial Ecology, Systems Biology, Holistic Resource Management, Industrial Ecology, Renewable Energy and Permaculture. As a senior Researcher at the Council for Scientific and Industrial Research (CSIR), an overarching research question is: How can our natural resources are used sustainably for the benefit of all? Current research involves assessing various technology options, value-chains and alternate development scenarios to guide project and policy developments for the transition to a Green Economy and a more sustainable development path. Bioenergy is currently a research focus area that addresses a multiple development objectives; such as economic feasibility, social acceptance, environmental impacts and the allocation of biomass resources for the production of food, fuel, timber, chemicals and fibres in the growing Bio-economy.

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