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Social and environmental impact for sustainable bio-gas production by the city of Johannesburg

Talent Chingono and Charles Mbohwa

University of Johannesburg Department of Quality and Operations Management
Bunting Road, Auckland Park, South Africa, Tel: +27 11 559 1169,
Email: tchingono@uj.ac.za : cmbowha@uj.ac.za

Abstract

The growth of biofuels production and use in South Africa can play a major role in job creation and can help alleviate poverty, improving environmental protection and economic growth. Bio-fuels has the potential to contribute to job creation and skills development in both agricultural and production sectors. It can spur economic development in disadvantaged rural communities, provide energy security, assist to mitigate the shortage and high cost of energy and can contribute to reducing greenhouse gas (GHG) emissions. The focus is mainly on the impact on workers and communities at large, where production and consumption generally takes place. This work is justified, mainly because there is growing customer/market pressure on the state of the social and economic circumstances of production and services for products like bio-fuel. Issues like corruption, unionization of workforce, policies and laws in the creation of bio-fuels and its by-products are increasingly being recognized. Outstanding social impacts were identified and authorities should strive to address

Keywords

Bio-gas, Social impact, plant impact, environmental impacts, South Africa.

I. Introduction and Background

City of Johannesburg (CoJ) is constantly growing, this has led to an increase in waste and also the demand for transport. The city tries to manage waste through landfills as available landfill space continues to reduce, waste generated within the CoJ has to be put into better use. This paper is part of an ongoing research project on how waste can be turned into bio-gas for use by the CoJ Municipality. Waste will be mainly gathered from Joburg Market's (JM) fruit and vegetable waste and Robinson deep landfill for biogas conversion towards serving as substitute to fossil fuel for the CoJ metro buses.

Renewable energy is deliberately seen as a road through which the South African Government can react to the challenge of environmental climate change, enhance energy security by broadening sources of energy supply, and move green development through localization and empowerment. Bioenergy can possibly break the cycles of poverty by creating energy security, job security, work creation, salary expansion and a coordinated advancement. The development of a biogas and bio-methane industry inside CoJ would stimulate financial advancement and pipe noteworthy income into the local. In its mission to end up carbon emission, the city government could play an initiative part by creating bio-methane at a premium keeping in mind the end goal to fuel its Buses. Bio-methane generation from natural waste is a viable, sensible and economical answer to alleviate GHG outflows and enhance air quality in the City of Johannesburg.

Research has demonstrated that the development of bio-fuels generation and use in South Africa can assume a noteworthy part in occupation creation and can reduce poverty, enhancing ecological security and monetary development. Bio-gas can possibly add to occupation creation and abilities improvement in both rural and agricultural

segments. It can goad financial advancement in impeded country groups, give vitality security, help to relieve the deficiency and high cost of vitality and can add to reducing greenhouse gas emissions (GHG)[2].

This work is also justified mainly by the growing customer/market pressure on the state of the social and economic circumstances of production and services for products like bio-fuel [9]. Issues like corruption, unionization of workforce, policies and laws in the creation of bio-fuels and its by-products are increasingly being recognized as important as they affect production largely [4]. The triple bottom-line of people, planet and profit or prosperity has become the pivotal of many development projects. Objectives Include, gathering information with regards to social and environmental parameters associated with biofuel production and to also assess the impacts of bio-gas production on employees, society and environment.

II. METHODOLOGY AND SCOPE OF STUDY

The study was directed all through the City of Johannesburg in the Gauteng Province of South Africa and it included a few partners, including, workers, neighborhood group individuals, government, and non-legislative association delegates related in the business. A greater emphasis was put at Robson deep land fill were a bio-gas plant was proposed to be erected. Information was predominantly gathered through observations and interviews. A desk-top research was also done to fill in the gaps in the data.

III. Social Impact

Positive social effects that would be generated as a consequence of venturing into bioenergy generation incorporates the making of work in pre and post-plant execution administrations to the CoJ appropriately trained students, local artisans, un-employed youth and entrepreneurs, through regular follow-up service, maintenance and repairs of plants. Generally, there is employment of skilled, semi-skilled and unskilled persons in the building and construction of the plant. Provision of clean and conservative energy is also another positive output. How local individuals are fused into future food/fuel frameworks will be critical for figuring out if cutting edge bioenergy frameworks can convey advantages to South Africa's poorest.

Extraordinary social effects where recognized and government ought to endeavor to address accordingly: Working conditions ought to be enhanced by strengthen the regulations regarding the casual daily laborer, such as improvements on wage and benefits, health and safety standards, and rights for collective bargaining. Concerning the negative impacts on the well-being of local communities, it is absolutely necessary for the government to take the measures to fully recognize and protect the rights of local communities who might be threatened by the expansion of bio-fuels industry including land use change other environmental hazards and implications.

IV. Impact of Plant

The most vital social and environmental worries, in order of priority were: smells, truck activity and air pollutants discharge. The three highlighted focuses have been evaluated towards how the impacted area will acknowledge such venture. The siting of the plant at Robinson deep will not reduce the traffic of truck around this environment but will assist in air pollution reduction. The dumping and mixing of waste in the mixing pit could create odor issues. To mitigate this potential problem, it would be recommended for the receiving pit to be as air tight as possible and equipped with a bio-filter to scrub any odors produced. Thus the construction and operation of an anaerobic digester should not present issues with the location of the plant.

Furthermore, if it could show responsible management practices, odor reductions and increased profitability for the CoJ, it is believed that this project would eventually be embraced all inhabitants of the area.

Assuming that all organic waste going to Robinson Deep landfill, 180,959 ton/yr, are diverted into an anaerobic digestion, CO₂ equivalent emission reduction will be 124,327.22 ton/yr. Other air pollutants could be avoided for using bio-methane as vehicle fuel rather than landfilling and flaring, a practice currently been employed at Robinson Deep landfill is presented in Table 11-1. The estimation presented here is a conservative estimation of the GHG reductions from anaerobic digesters when compared to open-waste exposure and landfilling of organic waste.

V. Environmental impact of biogas

When emitted directly to the atmosphere, from landfill sites for example, biogas can be a significant contributor to GHG emissions and thus climate change, as the CH₄ it contains has about 21-25 times the global warming potential of CO₂. GHG like CO₂ and CH₄ absorb energy and prevent the loss of heat to space. In this way, GHG forms a heat blanket making the earth warmer. H₂S is the most toxic gas emitted directly from biogas. It reacts with moisture in the air to form other acidic gases. Some studies suggest that H₂S has carcinogenic potentials. SO₂, NH₃ and NO_x react with moisture and other compounds to form various acidic compounds and ground level ozone. The acidic compounds return to earth in wet form as acidic rain, fog and in dry form as acidic gases. They reduce air quality, cause damages to public health, reduce visibility, lead to acidification and eutrophication of water bodies. Other dangers directly linked to landfills include; soil acidification, harm on sensitive forest and coastal systems and accelerated deterioration of materials like paints and artefacts such as buildings, statues and sculptures. Natural occurring ozone reduces the direct impact of ultra-violet rays from the sun but the ground level ozone has been linked to respiratory illness and other health problems. During the combustion of landfill sourced biogas, the nitrogen oxides produced has about 296-298 times the global warming potential of CO₂.

After upgrading, the use of bio-methane as fuel in vehicles, offers some positive properties regarding emissions. The combustion of CH₄ in the presence of O₂ will produce CO₂, water and energy (heat). Bio-methane create lesser emissions of CO₂, CO, hydrocarbons (HCs), particulates and sulphide compounds when compared to other fossil fuel source like gasoline and diesel but emits more NO_x if sourced from landfills or with considerable concentration of air. Well-to-wheel (WTW) life cycle analysis (LCA) for gasoline vehicles indicated that 170-190 g CO_{2,eq}/Km is emitted while for compressed biogas (CBG) vehicles, it ranges from -180-90 g CO_{2,eq}/Km depending on the source and type of substrate used to produce the biogas. The fumes from gasoline and diesel contain benzene and toluene which are not present in fumes from bio-methane.

VI. Conclusion

Real arguments distinguished incorporate the social states of laborers, the manhandle and misuse of immigrants, and the need to empower the previously disadvantaged colored race groups. It is in this way recommended a few laws securing human rights should be investigated and altered, in order to make a superior workplace Exploitative work relations, estrangement, and other negative effects on the prosperity of nearby groups are the most recognizable social hotspots that may prevent the maintainability of bio-fuels. These social hotspots uncover the way that the present condition of the improvement in bio-fuels industry is not socially legitimate. The local community and indigenous people are the most vulnerable and eventually bear these social costs. These scientific findings were also noted by

other reports published by activist groups [5], [7]. Exceptional social effects were recognized and government ought to endeavor to address thus: Working conditions should be improved by strengthening the regulations regarding the casual daily laborer, such as improvements on wage and benefits, health and safety standards, and rights for collective bargaining. Concerning the negative impacts on the well-being of local communities, it is absolutely necessary for the government to take the measures to fully recognize and protect the rights of local communities who might be threatened by the expansion of biofuels industry including land use change, other environmental hazards and implications.

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BIOGRAPHY

Tatenda Chingono is a PhD student with the University of Johannesburg in the Faculty of Engineering and the Built environment. He has conducted research in logistics, supply chain management, life cycle assessment and sustainability.

Charles Mbohwa is a Professor of Sustainability Engineering and currently Vice Dean Postgraduate Studies, Research and Innovation with the University of Johannesburg, SA. He is a keen researcher with interest in logistics, supply chain management, life cycle assessment and sustainability, operations management, project management and engineering/manufacturing systems management. He is a professional member of Zimbabwe Institution of Engineers (ZIE) and a fellow of American Society of Mechanical Engineers (ASME).