ON ACCELERATING UPTAKE OF BIO LATRINE SYSTEMS THROUGH PROVISION OF FINANCIAL INCENTIVES

TECHNOLOGY DESCRIPTION

TECHNICAL DESCRIPTION: TNA ENERGY MITIGATION

Biogas is one of the oldest technologies, which was disseminated in Uganda over the last 40 years. It is a combustible gas produced by the anaerobic fermentation of cellulose containing organic materials. Biogas normally consists of 45% to 75% methane, 25-45% carbon dioxide and 2%-3% moisture and about 1% trace gases. Biogas can be used as fuel for cooking, lighting, and heating. There are many biogas plants in Uganda mostly designed for households. The substrate or the feedstock for biogas plants are biodegradable biomass. These include food waste, cow dung, peelings, municipal wastes and faecal matter. Feedstock is mixed with appropriate amount of water, then poured into an air tight digester. The availability of water is very important. The anaerobic digestion takes place, biogas is produced, and the affluent called slurry is received at the outlet of the digester; this can be used as organic fertilizer. Large biogas plant operation is labour intensive. The most common types of digesters are the bag types and floating drum, which are not suitable for institutions because they have low capacities. The most suitable for institutions is the dome type digester. Generally, the maintenance cost of biogas plant systems is low.

Although biogas from faecal matter has been used in many countries, it started to take root in Uganda in the last five years. It is suitable for schools, old people homes, prisons and barracks. Experimental installations are found in schools and old people homes. Biogas can be used to supplement firewood use in institutions. In most cases, faecal matter is not enough to provide the necessary amount to meet energy demand in the institutions. The technology has not taken root well in Uganda. The performance of the large digesters can be improved by having an agitation system, pH. meter and temperature sensors. However, this will increase the installation cost of the biogas system. The power needed for the operation of the digester can be provided by solar.

CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

The current commercial readiness index for the bio latrine technology in Uganda stands at level 2 – pilot scale. Most of the bio latrine installations especially in schools are pilot projects by Ministry of Energy and Mineral Development. The demonstrations are intended to show the viability of the technology for it to be adopted by the institutions hence get to the commercial scale.

CLIMATE RATIONALE OF THE TECHNOLOGY

Methane is one of the greenhouse gases with high global warming potential (GWP). The value varies depending on the Assessment Report of the Intergovernmental Panel on Climate Change (IPCC). Based on the fifth assessment report, the global warming potential for methane is 28 CO_2 eq. The biogas combustion technology will eliminate the emission of methane by combustion to generate CO_2, which has the lowest GWP.

Most institutions use firewood logs as their primary source of energy for cooking. Unlike households, institutions do not depend on dead wood and small braches of trees. The use of firewood in institutions is one of the causes of deforestation. The combustion of wood generates CO_2 and other greenhouse gases such as methane (CH_4) and Nitrous Oxide (N_2O). Using biogas will reduce the firewood, hence more tress will be left for carbon sequestration. The odour during the emptying of latrines will be eliminated and general hygiene in institutions will be improved. One negative environment impact of biogas is that burning biogas also generates volatile organic compounds and nitrogen oxides, which are air pollutants and an ozone precursor, but the impact is limited.

A biogas system if well maintained can last for over 20 years. The schools may opt for 100% dependence on biogas, thus the savings in firewood would be 450,000 tonnes. This is expected to reduce emissions by 1,363,608 tCO2eq. in a period of 20 years. However, a school can depend on the biogas from feacal matter to meet 50% of the energy supply and use firewood to cover the remaining energy need. The savings on firewood will be 11,250 tonnes in a year, thus replacing 225,000 tons of firewood over the 20 years of the project.

Benefits of biogas technology include; smoke-free and ash-free kitchen, so women and their children are less prone to respiratory infections, construction of a bio-latrine improves sanitation and hygiene conditions which is essential for the overall health and well-being of the students and the rest of the school population.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

The Ambition is to construct 500 bio-latrines in 500 schools. There are two options; the school can depend on the biogas from feacal matter for 50% of the energy supply and use firewood to cover the remaining energy need for cooking. The second option is to construct one large system which will make the school self sufficient in clean energy. In this case the feedstock will be from feacal matter and other bio-degradable biomass resources, to meet the thermal needed by year 2030.

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EXPECTED IMPACTS OF THE TECHNOLOGY

- Job creation for construction of bio latrines, manufacturing of biogas stoves and burners system maintenance.
- The cooks both men and women in institutions will operate in smoke and ash free clean kitchens, with no indoor air pollutions.
- Improved health due to the fact that the systems have very low emissions and will be well ventilated
- Improved skills/capacity due to training opportunities especially builders of bio latrines and manufacturers of biogas stoves and the accessories such as gas burners and lamps
- Improved quality of lives in the kitchen
- Improves the security and reduces crime which occurs after nightfall in institutions since biogas lamps can provide light at night.
- Reduced GHG emissions since methane will not be emitted, it will be combusted to generate CO_2 which has low GWP.
- There will be general cleanliness since odour from latrines will be eliminated with improved waste management in the institutions
- Reduced deforestation due to replacement of firewood.
- Conservation of eco systems, since less trees will be cut to provide additional energy in schools, the rest of the tress will be left to sequester carbon and preserve the ecosystem.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

1. The National Climate Change Bill, 2020
2. Third National Development Plan, 2020/2021 – 2024/2025
3. The Energy Policy Uganda 2002, revised 2019
4. The Uganda Green Growth Development Strategy 2017/18 – 2030/31
5. Uganda Vision 2040
6. Uganda National Climate Change Policy 2015
7. Uganda's Determined Contribution (NDC) 2015
8. Uganda Second National Communication to the United Nations Framework Convention on Climate Change 2014

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

1. Policy on provision of financial incentives such as subsidies to off-set the high upfront costs which is a major deterrent to the deployment and diffusion of the technology. There are few items such as biogas gas lamps and efferent burners, but will eventually be made locally.

2. Policy on institutional development in the bio latrine / biomass energy sector, to ensure strong institutional frameworks and proper coordination among stakeholders.
3. Policy on skills development to build the capacity of the bio latrines construction and manufacturing of stoves and its accessories such as gas burners and biogas lamps workforce.
4. Policy and regulations for standards and quality of bio latrine systems.
5. Policy on innovation and technology to encourage local production of bio latrine system components; this is expected to reduce the high upfront costs.

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

The schools have two options , if the insitutions planned for 500 bio-latrines using fecal matter, with additional feedstock which includes cow dung, and other available biomass within the schools, such as food remains; peelings and other bio-degradable materials; theyare expected to cost $17,796,610. In that case the schools will be self-sufficient with biogas. However, if the schools would like to use the feacal matter (50%) and firewood (50%) , the 500 units will cost US$ 9,936,831. The cost of implimenting the policy is USD.450,000.

USEFUL INFORMATION

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