

## A.V.T.I BIOGAS SYSTEM

### Background

Cattle theft/ rustling in North Eastern Uganda between neighbouring tribes has led government to facilitate the formation of communal kraals to avoid the atrocities caused by the cattle thieves. These kraals are manned by soldiers. The huge number of animals in the kraals has given birth to very huge volume of fresh cow dungs that the community lacks a sustainable disposal approach. The AVTI has initiated a program of “Dung Security”. In this model, the institute fetch the cow dung from the communal kraal, makes biogas to cook in the school and the liquid slurry from the biogas is given back to the community as soil conditioner to promote the agriculture program of the school.

The successful implemented 12 m<sup>3</sup> biogas plant at the AVTI, showcase the potential of renewable energy in rural settings as the world combats effects of climate change. This innovative initiative leverages the abundant availability of cow dung in the region to generate clean energy and organic fertilizer which is eco friendly for the community as a return benefit.

### The Biogas Production Process

1. **Feedstock Collection:** Daily, approximately 160 litres (four 20L buckets) of fresh cow dung are collected from local community kraals. The quality of the feedstock is crucial for efficient biogas production, preferably fresh cow dung.
2. **Slurry Preparation:** The collected cow dung is mixed with water in an optimal ratio of 2:1 (dung: water) to create a slurry, implying for the four 20L buckets of cow dung, two 20L buckets of water is used for the mixing process. This ratio ensures optimal microbial activity for efficient biogas production.



*Figure 1: Slurry preparation*

3. **Anaerobic Digestion:** The prepared slurry is fed into the anaerobic digester, a controlled environment where anaerobic bacteria break down the organic matter in the absence of oxygen. This process generates biogas, primarily composed of methane ( $\text{CH}_4$ ) and carbon dioxide ( $\text{CO}_2$ ).
4. **Biogas Storage and Utilization:** The produced biogas is stored in a gas holder and piped to the institute's kitchen cooking stove. The burning time of the biogas, typically around 4-7 hours per day, can be influenced by factors such as flame balance, external conditions, and the quality of the feedstock. This is literally adequate to prepare soft meals, warm food, and boil water for cooking.



*Figure 2: students undergoing training at the biogas plant*

#### **Benefits:**

- **Clean and Renewable Energy:** Biogas provides a clean and renewable energy source, reducing reliance on traditional fuels like firewood and charcoal.



*Figure 3: Clean cooking with biogas*

- **Improved Air Quality:** By reducing the use of polluting fuels, biogas contributes to improved air quality and reduced greenhouse gas emissions.
- **Organic Fertilizer:** The digested slurry, rich in nutrients, can be used as organic fertilizer, enhancing soil fertility and crop yields.
- **Economic Benefits:** The biogas plant can generate additional income through the sale of surplus biogas or organic fertilizer.
- **Community Empowerment:** The project empowers the local community by providing sustainable energy solutions and promoting environmental awareness.

#### Challenges:

- **Consistent Feedstock Supply:** Ensuring a reliable supply of cow dung, especially during dry seasons, can be challenging.
- **Skill Development:** Training biogas plant operators is crucial for efficient operation and maintenance.
- **Infrastructure:** Adequate infrastructure, including pipelines and storage tanks, is essential for optimal biogas utilization.
- **Technological Limitations:** The efficiency of biogas production can be affected by factors such as temperature, pH, and organic loading rate.

By addressing these challenges and capitalizing on the opportunities, the biogas plant at Adilang Vocational Training Institute can serve as a model for sustainable development in rural areas.



Figure 4: demonstration plots at AVTI