CONDUCT R&D PROGRAMS TO ENLIGHTEN ON MANURE BASED BIOGAS DIGESTER IN VANUATU

TECHNOLOGY DESCRIPTION

Conduct productive studies to analyze labor intensive is reduced and strengthened institutional arrangements and cooperation between stakeholders

TECHNICAL DESCRIPTION

Manure-based biogas digesters is animal manure treatment and fermentation system which includes fermentation tanks, manure input and fermentation via anaerobic environment. The methane concentration of biogas is around 60%, so the recovery and utilization of biogas from digested slurry in a biogas digester will reduce CH4 emissions from the manure. In addition, the biogas can be used to provide electricity, energy and reduce CO2 emissions from fossil fuel (diesel) displaced by biogas.

The mechanics of biogas generation is similar to practice elsewhere which can be described as follows:

• The captured gas is stored in the upper part of the digester tank (gas storage area), which is constructed as an arc ship. The generation of biogas will gradually increase the pressure in the stored area. When the volume of the captured gas is larger than the amount consumed, the pressure in the gas storage will increase and slurry will be pushed into the outlet chamber. If the gas consumed exceeds gas availability, the slurry level drops and the fermented slurry flows back into fermentation chamber.

• The placement of the digester tank (underground fermentation) keeps the temperature in the tank relatively stable ensuring that the slurry can be fermented at adequate temperatures throughout the year without requiring additional heating.

• The bottom of the digester inclines from the material-feeding inlet to the material-outlet, allowing free flow of the slurry.

• The digester has been designed to allow the effluent to be removed without breaking the gas seal, taking the effluent liquid out through the outlet chamber. As pointed out in technology definition biogas fermentation is a process in which certain bacteria decompose organic matter to produce methane. In order to obtain normal biogas fermentation and a fairly high gas yield, it is necessary to ensure the basic conditions required by the methane bacteria are met for them to carry out normal vital activity (including growth, development, multiplication, catabolism etc.).

CURRENT TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

CRI Level 2, commercial trial in that MBBD is in early stage of development, public support and creation of enabling environment for diffusion is remained crucial

CLIMATE RATIONALE OF THE TECHNOLOGY

Microbes that play a major role in biogas fermentation are all strict anaerobes. In an aerobic environment, the decomposition of organic matter produces CO2, however, in an anaerobic environment, it results in CH4. A strict anaerobic environment is a vital factor in biogas fermentation. Therefore, it is essential to build a well- sealed, air-tight biogas digester (anaerobic digester) to ensure a strictly anaerobic environment for artificial biogas production and effective storage of the gas to prevent leakage or escape

Sufficient raw materials for biogas fermentation constitute the material basis for biogas production. The nutrients that methane bacteria draw from the raw materials are carbon (in the form of carbohydrates), nitrogen (such as found in protein, nitrite, and ammonium), inorganic salts, etc. Carbon provides energy, and nitrogen is used in the formation of cells. Biogas bacteria require a suitable carbon-nitrogen ratio (C: N). The suitable carbon-nitrogen ratio for rural biogas digesters should be 25~30:1. The carbon-nitrogen ratio changes with different raw materials, and one must bear that fact in mind when choosing a mix of raw materials for the digester.

The appropriate dry matter concentration in the raw materials for biogas fermentation in rural areas should be 7%~9%. Within this range, a low concentration of raw materials may be selected in summer, while in winter a higher value is preferred.

Biogas fermentation rates depend greatly on the temperature of the fermenting liquid in the digester. Temperature directly affects the digestion rate of the raw materials and gas yield. Biogas fermentation takes place within a wide temperature range (XuZengfu, 1981). The higher the temperature, the quicker the digestion of the raw materials will be, and the gas production rate will also become higher. Based on real fermentation conditions, we have identified the following three temperature ranges for fermentation:

• High temperature fermentation: 47°C~55°C

• Medium temperature fermentation: 35°C ~38°C

• Normal temperature fermentation: ambient air temperature of the four seasons. Selecting the temperature range for biogas fermentation depends on the type, sources, and quantities of raw materials; the purposes and requirements of processing organic wastes; and their economic value. Most household biogas digesters are normal temperature fermentation.

The pH value of the fermenting liquid has an important impact on the biological activity of biogas bacteria. Normal biogas fermentation requires the pH value to be between 7 and 8. During the normal process of biogas fermentation in a rural digester, the pH value undergoes a naturally balanced process, in which it first drops from a high value to a low value, then rises again until it almost becomes a constant. This process is closely related to the dynamic balance of three periods of biogas fermentation. After feeding the biogas digester, the time that the pH value takes to reach its normal level depends on the temperature and the kinds and amounts of raw materials that are fed in.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

Vanuatu had greater potential to adopting this technology and may be applied to residence that has septic tanks buried under and close to the house. All residence in the urban or rural areas do have existing tanks that can be utilized for this purpose.

And the timeline for the implementation of the policy 4 to 5 years.

AMBITION FOR TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

CRI-Level 3 –commercial scale up, this can be addressed through effective productivity surveys to see where savings in time and effort by workers can be reduced.

EXPECTED IMPACTS OF THE TECHNOLOGY

The Manure Based Digester will definitely reduce waste that has to be transported out of site and be dumped on the designated area allocated by the municipal council.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

The national policies and strategies includes;

1. National Sustainability Development Plan 2016 to 2030

2. Updated Vanuatu National Energy Road Map 2016 to 2030

3. National Determined Contribution 2020 to 2030

4. Waste Management Act

5. Third National Communication, 2020

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

1, GHG Emission Policy

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

Indicative total project cost (UNDP + co-finance) is VUV15M

USEFUL INFORMATION

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LINKS TO TNA REPORTS

https://tech-action.org/