SMALL-SCALE BIOGAS DIGESTERS IN A MIXED AGRICULTURAL SYSTEM IN LESOTHO

TECHNOLOGY DESCRIPTION

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Energy provision is an important need for societal development. Biogas is one of the renewable energy sources that can provide a sustainable solution to increasing energy demand. This technology utilizes organic waste can be easily adaptable to remote homesteads that may be hard to connect to the national electricity grid.

Cattle produce greenhouse gas emissions from their dung and urine, and enteric fermentation. The common practice by many households in Lesotho is that cattle dung that is left in the kraals or collected in the rangelands is dried and used as a source of fuel in the form of *lisu* (dried cow dung).

Cattle dung can be used to produce methane (CH_4) under anaerobic conditions in biogas biodigester units and the gas can be used as a source of clean energy for the household. The biogas digestate downstream of the plant, can be used as organic manure for vegetable production in the garden. This digestate which is in liquid form reduces costs of manure for farmers and also assists with irrigation of crops. The technology can therefore have additional benefits by improving soil fertility, soil carbon content and household food security. The use of biogas can also improve air quality in homes by eliminating the smoke from the burning of *lisu*.

Biogas digesters are optimum at 35 ^oC and CH_4 production drops significantly when temperatures drop below 20 ^oC. Low temperatures which are a norm in Lesotho in winter can reduce the efficiency of biogas systems. Biogas systems can be constructed using prefabricated units or be built using bricks and mortar. Costs associated with each type of material used for construction are different. Construction of a biogas plant that can support a household of five people requires, for example, an average capital cost of LSL 20 000 and a herd of between five and ten cattle that are kraaled at night. Subsistence farmers and small-scale farmers may need assistance with capital costs and access to financial institutions.

CLIMATE RATIONALE OF THE TECHNOLOGY

Climate Change Mitigation:

- **Reduced Emissions**: Biogas digesters can reduce GHG emissions from CH_4 which when used for energy provision is converted to CO_2. The latter forms emissions not from burning of fossil fuels and can be readily absorbed by vegetation, making the net effect of zero emissions. A biogas digester fed with 60 kg of wet cow dung (30 kg cow dung and 30 litres of water) every five days can produce 1.25 m^3 (581 kg) of CH_4 every day or 5.87 kWh of electricity[1]. Assuming a global warming potential of 21, abated CH_4 translates to 12 200 kg of CO_2 equivalent.

Climate Change Adaptation:

- **Resilience to Climate Extremes**: Biogas slurry continuously provides water for gardens and orchards downstream of the biogas plant. This continuous "irrigation" can assist production of various crops even during drought conditions.

AMBITION OF THE TECHNOLOGY

[1] main.pdf (sciencedirectassets.com)

SCALE FOR IMPLEMENTATION AND TIME-LINE

The technology can currently be implemented in pilot project with selected beneficiaries/farmers. The purpose of pilot projects is to develop local capacity throughout the value chain and to generate knowledge (lessons) that can inform out scaling of implementation and the commercialization. The ambition set out in the Technology Action Plan (TAP) is to develop at least one hundred biogas digesters in farming households and emerging commercial dairy farmers in Lesotho, to create sustainable renewable energy and to reduce farm emissions. The pilot of the technology will focus on organized dairy farmers that are in the lowlands where they will be closer to the markets and the impact of low winter temperatures limited.

It is anticipated that implementation of pilot projects and development of enabling frameworks can be achieved in four years (2025 – 2028).

EXPECTED IMPACTS OF THE TECHNOLOGY

In addition to climate change mitigation impacts, the production of biogas digesters is also expected to have the following impacts:

Environmental Protection:

- **Soil Health Improvement**: Biogas slurry can improve soil organic matter and fertility. This improves soil structure, nutrient availability, soil water holding capacity and microbial activity.

Socio-Economic Benefits:

- **Enhanced Food Security**: Organic manure from biogas slurry can be used in the gardens and fruits. This application can increase production of fruits and vegetables which can be grown as cash crops (income generation) and for household consumption (food security).
- **Energy generation**: Biogas produces CH_4 which can be used as source of energy in the household. This will remove the necessity of women and girls to go out to the fields and forests to collect firewood. It will also save money for households by reducing expenditure on LPG and paraffin for cooking and space heating.
- **Economic Opportunities**: If produced at large quantities and commercialised, biogas can be sold to generate economic opportunities.
- **Generation of organic manure**: Biogas slurry from biogas digester systems can be used as manure in orchards and gardens. This can reduce the use of synthetic fertilizers which are major sources of N_2O emissions.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

Existing policies are the following:

1. National Strategic Development Plan II (2018/19 – 2022/23).
2. National Climate Change Policy (2017 – 2027).
3. National Climate Change Policy Implementation Plan (2017 – 2027).
4. Nationally Determined Contribution (2017).
5. National Energy Policy (2015 – 2025).

6. Scaling-Up Renewable Energy Programme Investment Plan (2017).

PROPOSED POLICIES TO ENHANCE TECHNOLOGY IMPLEMENTATION

Proposed policies that can enhance technology implementation include the following:

1. Development of policies that will focus specifically to promotion of biogas technologies in the country.
2. Policy to provide sustainable funding for the technology
3. Policy to support women involved in this technology
4. Policy to improve institutional and human capacity regarding this technology

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

Strengthening the Regulatory Framework: USD 100 000 per year. This cost includes development and enforcement of policy and regulations for biogas digester technology in the country.

Providing Financial Incentives and Financing: USD 200 000 once off. The cost includes capital costs of hundred units and provision of other prerequisite resources (e.g. transportation from manufacturers).

Strengthening Institutional Capacity and Coordination: USD 500 000 per year. The cost includes provision of resources to enable institutions to employ people with required skills, collect data and conduct research.

Promoting Public Awareness and Behaviour Change: USD 50 000 per year. This cost will assist fund the campaigns that will be used to promote the technology to the farmers and the public.

Monitoring, Evaluation, and Continuous Improvement: USD 200 000 per year. This cost includes procurement and maintenance of equipment that can be used to monitor implementation of the technology. This will cover monitoring of biogas digester imports at the ports into the country.

USEFUL INFORMATION

CONTACT DETAILS

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LINKS TO TNA REPORTS

https://tech-action.unepccc.org/country/lesotho/