BIOGAS TECHNOLOGY - WHAT WORKS FOR GHANA?

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Presentation Outline

- What is Biogas?
- Typical Biogas Plants in Developing Countries
- Benefits of Biogas
- Case Studies of Biogas Projects
- Conclusion
Biogas Technology - What is it?

- **Biogas** typically refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen.

- Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste.
TYPICAL PLANTS IN DEVELOPING COUNTRIES
TYPICAL BIOGAS PLANTS IN AFRICA

Figure 4: Chinese fixed dome plant
Source: TBW

Fixed Dome Plant under construction in Ghana.
Photo: REES
TYPICAL BIOGAS PLANTS AFRICA

Floating Drum Plant

Photo: giz/GATE

Floating drum plant in Burkina Faso
BENEFITS OF BIOGAS

• Energy
  • Heat – Cooking, Lighting, space heating
  • Fuel Engines for mechanical power or Electricity generation

• Sanitation
  • Organic waste treatment - destroys disease carrying bacteria

• Agriculture
  • Rich organic manure with higher nitrogen content.
BIOGAS DEVELOPMENT IN GHANA

- Research & Development of biogas in Ghana dates back to the late 1960s
- Over 100 biogas plants have been constructed nationwide.
- Objective has mainly been to provide energy for cooking and electricity generation.
- The treatment of the organic matter to address issues of sanitation and the use of the digested slurry for agriculture have not been the main driving factor for the investment.
- Unfortunately most plants failed shortly after the duration of the project.
- The presentation therefore sought to look at some case studies to establish best application for biogas technology.
Case Studies of Biogas Plants In Ghana

- HPW Fresh and Dry Ltd Biogas Plant
- Ghana Oil Palm Development Company (GOPDC) Biogas Plant
- Ejura Slaughterhouse Biogas Plant
- Ntiamoah Hotel Biogas Plant
- Mfantsipim Senior High School’s Biogas Plant
- Appolonia Biogas Plant
HPW Fresh and Dry Biogas Plant

- HPW is a fruit processing company located at Adeiso, in the Eastern Region.
- Two 450m³ concrete biogas digesters and three 100 m³ gas holding balloons.
- Averagely 500m³ of gas is produced daily from the plant.
- Effluent recirculated to the farm
Problems with HPW Fresh & Dry Biogas Plant

- High pH of substrate resulting in low methane content of about 49%
- The concrete type digester weakening due to the high acidic substrate.
- The holding balloons are frequently punctured as they are left unprotected from the weather.
GOPDC Biogas Plant

- GOPDC extracts and refines crude palm oil and palm kernel oil at Kwae in the Eastern region of Ghana.
- It has about 22500 hectares of oil palm plantations at its Kwae and Okumaning estates.
- The processing plant produces an average of 210,000 tonnes of oil per year.
- The palm oil mill effluent (waste water) is harnessed for biogas production.

Effluent from the Mill being disposed and channelled into the biogas reactor
Two 1000m\(^3\) biogas plants produces about 18000m\(^3\)/day biogas for heat and steam generation for the refinery plant processes.

- Displaced the 615,000 litres of diesel that was previously consumed by the plant per year.
- The Plant cost 4.5 million euros with a payback period of 11 years.
- Problem of insufficient palm fruits for processing

Slurry is treated in a pond before used as fertilizer for plantation.
Ejura Slaughterhouse Biogas Plant

- The 50m³ twin bio-digester was built to treat the slaughterhouse waste and to produce biogas for singeing cattle in 2000.
- The facility has been abandoned since 2005.
The explosion of the gasholder rendered the facility useless.
The effluent storage tank got filled with sand and rubbish as the area was prone to flooding.
Ntiamoah Hotel Biogas Plant

- Located at Agona-Swedru in the Eastern Region of Ghana.
- The hotel has a 10m$^3$ biogas facility constructed to provide biogas to supplement LPG use in the kitchen.
- Silage and faecal matter from the hotel is used as feedstock for the digester.
- The digested slurry is used for watering the hotel garden.
- Gas is inadequate to meet cooking energy needs
- Challenges include spoilt flow meter and broken down effluent storage pump.
Mfantsipim SHS Biogas Plant

- 16-seater, 200m3 fixed dome biogas toilet facility with effluent filtration system
- Gas lamps installed in the toilet facility.
- Filtered effluent is pumped to an overhead tank for flashing.
- The school has a 350kVA biogas generator was also provided to supply power to one of the houses.
- System Not functioning No enough gas to power Generator
- Major challenge is the lack of funds for maintenance
- Clogging of pipes.
Bio-toilet systems in boarding Senior High Schools
Bio-toilets in Junior High Schools
Successful Biogas Plants

• No cost is involved in the supply of biogas feedstock
  • Dairy farm with zero grazing
  • Slaughterhouses
  • Industries producing organic waste and had to pay for proper disposal
    • Breweries
    • Vegetable oil producing industries
    • Food processing industries etc
  • Central sewage systems/ public toilet facilities

• Construction cost of plant is supported by donors

• Strict implementation of environmental laws for waste disposal
Conclusion

• The biogas technology has been used in Ghana for cooking households, direct lighting, small power generation, and bio-sanitation.

• Biogas for cooking in households has not been successful.
  • Most household biogas plants abandoned.

• Biogas for lighting has also not be very successful.
  • Too much heat is generated in the room.

• Biogas for electricity generation is competitive with diesel plants if the feedstock is obtained at little or no cost to the site.
CONCLUSION

- Bio-sanitation has been the main driving factor for successful biogas plants in Ghana.
- Energy and fertilizer are therefore considered as by-products.
- For most of the operating plants are either flared or released without utilization.
- Cost: Investment cost of biogas plant is usually high ($1,700 - $5,000) for rural farmers.
- Feedstock and water: The technology is limited to locations where the organic feedstock and water are readily available.
- Utilization: Given digester sizes have different rates of biogas generation. This means that utilization is restricted by the rate of production.
- There is no policy incentive for the promotion of biogas in Ghana.
A biogas Plant has to fit the existing farming, production or waste disposal systems. Attempts to make the system fit to the biogas plant will result in expensive and frustrating failures.

Thank You

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