

GENERATION OF ELECTRICITY AND BIO MANURE THROUGH DECENTRALIZED WASTE TREATMENT



A SAJI DAS, DIRECTOR, BIOTECH, THIRUVANANTHAPURAM, KERALA

In accordance with the fast-growing population, the demand for energy and the discharge of waste are increasing day by day. The only remedy to the energy crisis is the use of alternative energy sources. And one of the best alternative ways is the generation of energy from waste, which is beneficial in several ways. It is most suitable for eco-friendly waste disposal and also for energy generation.

To find out a permanent solution to the problem of contagious diseases

caused by the accumulation of waste, it is quite necessary that we extend the scheme of implementation of decentralized waste treatment programmes all over the country. Biogas technology enables us to produce bioenergy in households by treating the waste generated. This technology is also applicable to treating the waste produced from public places like markets, slaughter houses, hotels, and so on and for generating electricity without causing any pollution to the atmosphere.

Technology adoption for fast degradable materials

Through the utilization of biogas technology (Biomethanization) for decentralized waste management, the collection, transportation, and segregation of waste can be totally avoided as the wastes are treated at the source itself.

Biomethanization technology

Biomethanization is a universally accepted and proven technology for bioenergy generation from bio waste.

It is very simple, user-friendly, and needs no recurring expenses. Through the adoption of biomethanization technology, all degradable waste can be treated with the help of different types of anaerobic bacteria/microbes in a concealed chamber/digester. The treated biomaterials that come out of the digester in liquid or semi-liquid form can be used as a very good bio manure/organic fertilizer.

Generation of electricity from biogas

The main advantage of the waste-to-electricity project is that no external power is required for the operation of the plant. The power generated in the treatment plant can be utilized to meet the in-house requirement completely. Excess quantity can be utilized for any type of application, including street lighting, providing lights to the markets, and the likes.

Generally, 1.5 KW (kilowatt) of electricity can be produced from one cubic metre of biogas. Depending upon the percentage of methane content in biogas, the power generation may vary slightly. The size of the generator can be fixed depending upon the availability and the quantity of gas and the duration for the requirement of power. The gas can be utilized as the



operation fuel in generators. Before feeding biogas as the fuel in generator, the gas has to be passed through a gas scrubber to remove unwanted particles, gases, moisture, and so on.

Two types of generators are used for generating electricity from biogas. One is the dual fuel model and the other is the 100% biogas model. Dual fuel models are basically diesel generator sets. In this system, the biogas is connected to

the generator through air mix. Once the biogas is passed through the generator, the consumption requirement of the diesel is automatically reduced. Usually, dual fuel generators work in 80%–20% mode.

In the 100% biogas engines, no other fuel is required either for starting or for operating them. Any type of petrol engine can be modified for operating the same, using biogas as the operation fuel. The imported models of 100% biogas engines are very costly and the maintenance of such systems is also very expensive. BIOTECH, a Kerala-based non-governmental organization, has developed 100% biogas engines, which have been installed in various projects. And the performance of all of them has been very good.

Operation of waste-to-electricity plant

The biowaste generated in fish and vegetable markets, slaughter houses, and so on are collected in separate bins,



BIOTECH

BIOTECH-Kerala is a registered non-governmental organization that started functioning from 1994. The main activities of BIOTECH, from its very inception, include promotion, implementation, training, research and development, and creation of awareness among the people in the field of creation of renewable energy by waste management.

Different models of plants for the treatment of waste, according to the requirement of the consumers and the nature of waste, have been developed by BIOTECH. These models cater to the needs of different categories of beneficiaries, such as domestic households, public institutions like hospitals, schools, hostels, and convents, and local body establishments like Panchayats, municipalities, corporations, and the likes, for treating different types of waste. BIOTECH has successfully installed around 15 000 family-size plants with the financial assistance from the MNRE (Ministry of New and Renewable Energy), Government of India, and with the active cooperation of the local bodies.

BIOTECH also renders consultancy services for the preparation of projects, conducts feasibility studies, and undertakes project implementation. In recognition of its selfless services to the society, BIOTECH was conferred the prestigious International Ashden Award—GREEN OSCAR 2007.

meet the in-house requirement and for street lighting. The treated biowaste can be collected from the pre-digesters, which can be utilized as biomanure.

Biomanure

The treated biowaste material from the digester is in liquid or semi-liquid form. This is a very good fertilizer for all types of plants. This can be mixed with equal or more quantity of water and directly applied to plants. The solid manure from this slurry can be separated through the filtering process. Filtered liquid can be utilized and the solid fertilizer can be kept for later use. The treated solid biomanure can also be collected directly from the pre-digester developed by BIOTECH. The biomanure generated by the treatment of biowaste is a better substitute of chemical fertilizer. Through its utilization, the huge amount of money spent for purchasing chemical fertilizers can be saved to a great extent. The growth ratio of plants would also highly improve within a short period of time. In addition, the resistance power of plants from insects will be improved. In short, the treated slurry can be called a tonic for plants. And this is not all. The water storage capacity of the soil will also be improved through the application of solid biomanure. The presence of insects in the soil can also be avoided to an extent.

which are carried to the treatment plant site. After final sorting, easily degradable biowaste is allowed to pass into the digester/reactor. Slow degradable materials are fed into the pre-digester and the treated slurry is mixed with this feed material every day. The leachate from the pre-digesters is extracted through specially designed filters and channelized to the digesters for biogas production. The organic waste thus fed into the plant decomposes within days through anaerobic process and

the methane gas generated is collected in the gas holder of the plant. For the effective operation and long life of the generators, the gas generated has to be purified before utilization. For eliminating H₂S (hydrogen sulphide), unwanted dust, and moisture content, this gas is allowed to pass through filters and gas scrubbers developed by BIOTECH. After filtration, it is channelized to the generator for electricity generation. Electricity thus generated from the plant is utilized to



Types of wastes that can be treated under Biomethanization Technology

All easily degradable materials, including cooked and raw food wastes; fruits and vegetable waste; fish and meat waste; excreta of all domestic and wild animals and birds; and wastewater containing biowaste materials can be treated with this technology. Slow degradable materials like vegetables and green or wet plant parts can also be treated with this technology, using specially designed pre-digesters.

The main parts of a waste-to-electricity plant

Digester, gas collector, anaerobic pre-digester, slurry loop system, 100% biogas generator, standby generator,



biogas scrubber, dehumidifier, control panel, power distribution system, and Exes Gas reservoir.

History of waste-to-electricity projects in Kerala

Kerala's first biowaste treatment power generation plant was installed eight years ago at Pathanapuragm Gram Panchayat in the Kollam District. This plant treats 250 kg of organic waste and generates 3 KW of electric power every day. After the successful completion

of this project, 42 Gram Panchayats in Kerala came forward for the installation of such plants. BIOTECH has completed the installation of the power generation projects using market/slaughter house waste with power generation capacities ranging between 3 KW and 10 KW. The power generated from these projects is being utilized to meet the energy requirements of the concerned markets and the in-house requirement of

the plant.

Specialty of BIOTECH waste-to-electricity projects

1. There is no need of using grid electricity for the regular operation of the plant. A part of the power generated from the plant is utilized to meet its in-house requirement.
2. There are less moving parts or complicated machineries.
3. The introduction of anaerobic pre-digesters helps to treat the

waste completely and to collect the treated waste. It checks scum formation in the plant. The inbuilt slurry loop systems accelerate the fermentation process and reduce the consumption of water. A part of the treated slurry is also sold as liquid organic fertilizer.

If similar decentralized waste treatment plants are installed all over country, it would be very helpful for the production of biogas, electricity, and biomanure, apart from the treatment and disposal of unwanted waste. We wish that similar projects may be implemented all over the country with the cooperation and support of all concerned.

For more information about waste-to-electricity projects, contact:

Director, BIOTECH
PB No. 520, M P Appan Road,
Vazhuthacadu, Thycadu P O,
Trivandrum, Kerala—695 014
Tel.: +91 471-2332179, -2321909
E-mail: biotechindia@eth.net
Website: www.biotech-india.org