

RENEWABLE ENERGY – BIO MASS

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Abstract: Biogas is a renewable energy source. Biogas 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. Biogas is a gaseous fuel and serves as a good source of energy for various purposes. The biogas can be used for fuelling for vehicles. Bio gas serves as evidence of those practical actions that are taking us towards the low-carbon society of the future. Biogas is used as fuel for combustion engines, which convert it to mechanical energy, powering an electric generator to produce electricity. The generation of a combustible gas from anaerobic biomass digestion, is a well-known technology. There are already millions of biogas plants in operation throughout the world. Whereas using the gas for direct combustion in household stoves or gas lamps is common, producing electricity from biogas is still relatively rare in most developing countries. In Germany and other industrialized countries, power generation is the main purpose of biogas plants; conversion of biogas to electricity has become a standard technology.

Keywords: Biomass, Renewable energy, Electricity, Agricultural waste.

I. INTRODUCTION

Access to energy is a key pillar for human wellbeing, economic development and poverty alleviation. Ensuring everyone has sufficient access is an ongoing and pressing challenge for global development.

However, our energy systems also have important environmental impacts. Historical and current energy systems are dominated by fossil fuels (coal, oil and gas) which produce carbon dioxide (CO₂) and other greenhouse gases- the fundamental driver of global climate change. If we are to meet our global climate targets and avoid dangerous climate change, the world needs a significant and concerted transition in its energy sources. Balancing the challenge between development and environment therefore provides us with an ultimate goal of ensuring everyone has access to enough sustainable energy to maintain a high standard of living.

Electrical energy is produced from many different energy sources. Some of these energy sources are renewable and others are non-renewable. The percentage of electrical energy produced from various sources of energy in general and in India is given in Fig. 1

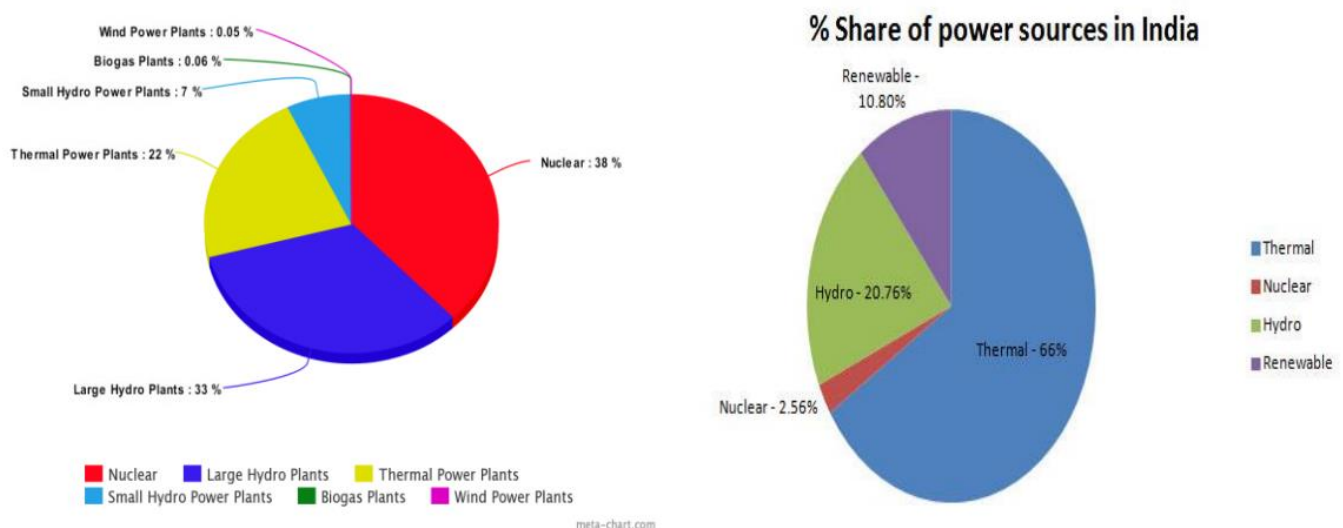


Fig. 1 Electrical energy generation % share of power in general and in India

Most of the electricity used in India is made from power plants that burn fossil fuels to create steam. The main type of fuel used is coal, because it allows large amounts of electricity to be produced in one place. Coal currently accounts for over 66% of India's electric power. Electricity is generated through coal-fired power stations. Coal is a non-renewable source which means it will eventually run out. It is important we preserve our coal resources and look for more environmentally friendly ways of producing electricity. There are other ways of generating electricity by using natural resources that can be replaced or renewed without harming the environment or contributing to the greenhouse effect.

II. POWER GENERATION FROM RENEWABLE ENERGY:

1. Hydro: Electrical energy created from water stored in huge dams. The Energy Created by the water released from these dams is transformed into electricity by hydro-electric turbines and generators. In India, large hydro: 126,123 GWh (9.7%) , small hydro: 5,056 GWh (0.4%)

2. Sun: By generating electricity through the sun we prevent the release into the atmosphere of around 500 tons of greenhouse gases each year. In India, solar power: 25,871 GWh (2.0%)

3. Wind: Moving air which is created when the sun heats the air and cooler air moves in to replace it. This causes wind. Through the ages people have learned to harness the wind's energy. Like the sun, it can also be used to create electricity. Wind power generates 52,666 GWh (4%).

4. Geothermal: Energy from the heat of the earth. It has been used for thousands of years in some countries for hot water, cooking and heating. It can also generate electricity using steam produced from heat found beneath the surface of the earth.

5. Biomass: Energy which comes from landfill-or rubbish dumps. It includes energy from both animal and plant matter. Landfill gas is created when the waste you throw away starts rotting (or decomposing) in the ground. This gas would normally just seep through the ground and into the atmosphere, contributing to environmental problems, like the greenhouse effect.

However, it can be captured and processed to create electricity. It is collected, dried (to get rid of any water), and then filtered (to get rid of any waste particles). It is then fed through pipes to a gas generator that burns the gas to create electricity. In India, Electricity production from Biomass: 15,252 GWh (1.2%)

In this paper we will present how the electricity is generated from biomass.

III. BIO GAS PRODUCTION:

Biogas is the mixture of 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. Biogas is a renewable energy source.

Biogas is produced by anaerobic digestion with methanogen or anaerobic Organisms, which digest material inside a closed system, or fermentation of Biodegradable materials. This closed system is called an anaerobic digester, bio Digester or a bioreactor. Biogas is primarily methane (CH_4) and carbon dioxide (CO_2) and may have small Amounts of hydrogen sulfide (H_2S), moisture and siloxanes. The Gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen. This energy release allows biogas to be used as a fuel; it can be used for any Heating purpose, such as cooking. It can also be used in a gas engine to convert the Energy in the gas into electricity and heat. Biogas can be compressed, the same way as natural gas is compressed to CNG, and used to power motor vehicles. In the United Kingdom, for example, biogas is estimated to have the potential to replace around 17% of vehicle fuel. It qualifies for Renewable energy subsidies in some parts of the world. Biogas can be cleaned and Upgraded to natural gas standards, when it becomes bio-methane.

Biogas is considered to be a renewable resource because its production-and-use cycle is continuous, and it generates no net carbon dioxide. As the organic material grows, it is converted and used. It then regrows in a continually repeating cycle. From a carbon perspective, as much Carbon dioxide is absorbed from the atmosphere in the growth of the primary bio resource as is released, when the material is ultimately converted to energy.

Biogas is produced using well-established technology in a process involving several Stages:

1. Bio waste is crushed into smaller pieces and slurried to prepare it for the anaerobic digestion process. Slurrifying means adding liquid to the bio waste to make it easier to process.
2. Microbes need warm conditions, so the bio waste is heated to around 37 °c.
3. The actual biogas production takes place through anaerobic digestion in large Tanks for about three weeks.
4. In the final stage, the gas is purified (upgraded) by removing impurities and Carbon Dioxide. A material suitable for biogas production includes:
 - Biodegradable waste from enterprises and industrial facilities, such as surplus Lactose from the production of lactose-free dairy products
 - spoiled food from shops
 - Bio waste generated by consumers
 - Sludge from wastewater treatment plants
 - Manure and field biomass from agriculture

IV. CONVERSION TO ELECTRICITY:

Theoretically, biogas can be converted directly into electricity by using a fuel cell. However, this process requires very clean gas and expensive fuel cells. Therefore, this Option is still a matter for research and is not currently a practical option. The conversion of biogas to electric power by a generator set is much more practical. In contrast to Natural gas, biogas is characterized by a high knock resistance and hence can be used in Combustion motors with high compression rates.

In most cases, biogas is used as fuel for combustion engines, which convert it to mechanical energy, powering an electric generator to produce electricity. In most Cases, biogas is used as fuel for combustion engines, which convert it to mechanical Energy, powering an electric generator to produce electricity.

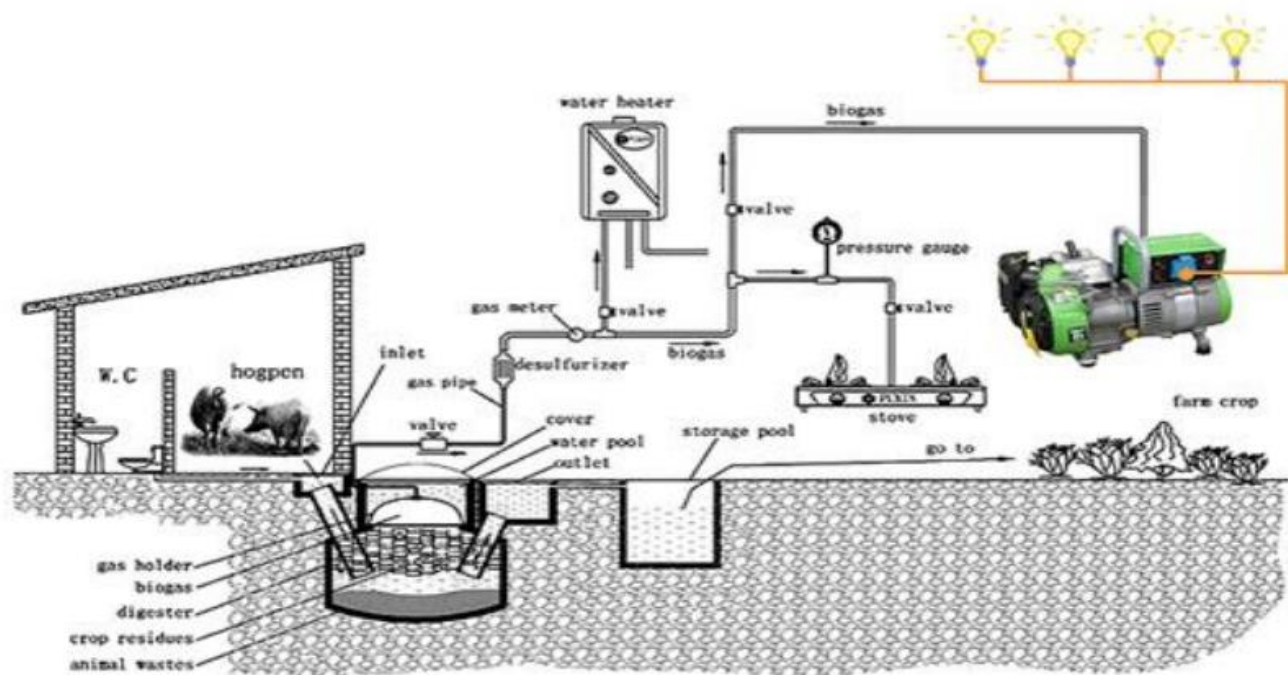
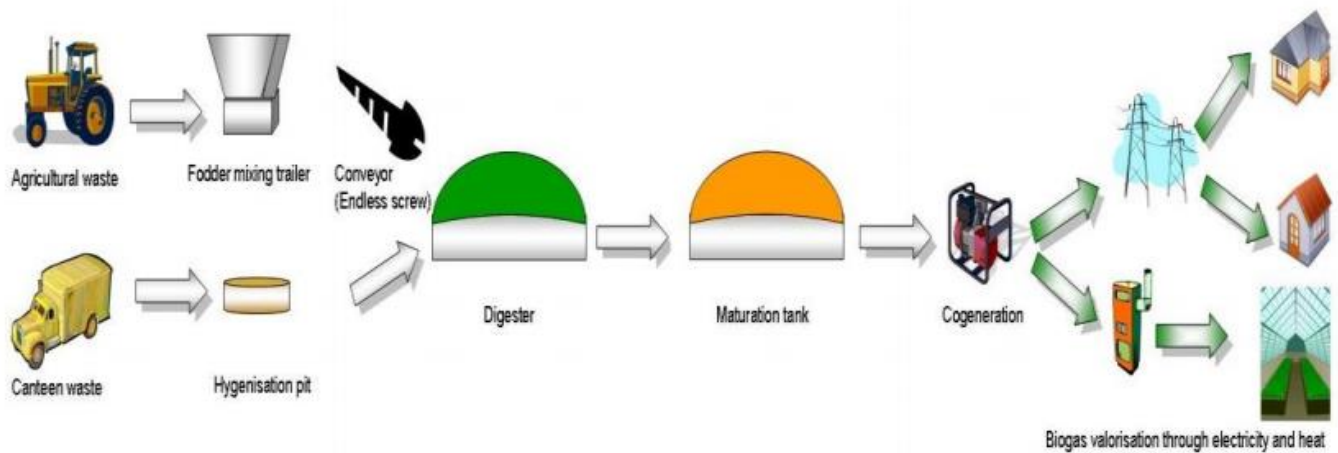


Fig. 2 Schematic of a biogas plant used for power generation

V. ECONOMIC ASPECTS:

Economically, electricity from biogas must compete with electricity generation from Fossil fuels and other renewable energies such as hydro power. Supporting factors are:

- Rising prices of fossil fuels
- Low reliability of electricity provision from national grids with persistent risk of Power cuts and vulnerability of hydro power to drought.

Inhibiting factors are:

- Relatively low prices of fossil fuels
- Need to buy high quality components from industrialized countries
- Unfavorable conditions for selling electricity
- Lack of awareness, Capacity and experience preventing the economic operation of Infrastructure components.

The economic feasibility of a biogas plant depends on the economic value of the entire Range of plant outputs. These are:

- Electricity or mechanical power
- Biogas
- Heat, co-generated by the combustion engine
- The sanitation effect with cod and bod (chemical and biological oxygen Demand) reduction in the runoff of agro-industrial settings
- Slurry used as fertilizer.

Most of the commercially run biogas power plants in developing countries are of Medium size and are installed in industrial contexts, primarily using organic waste Material from agro-industrial production processes such as cow, pig and chicken manure, Slaughterhouse waste, or residues from sisal and coffee processing.

In spite of this theoretical profitability, recent examples from Africa show that Electricity generation from biogas has not really captured the market as a 'profitable' Technology. Almost all well-known biogas power plants in developing countries depend On financial support from a third international party. In Germany, power generation from Biogas is only profitable due to grid connection and sup-orting feed-in tariffs. By Contrast, power generation in most developing countries seems to be especially profitable In settings far away from the national grid and other energy sources, as the legal Framework conditions and the lack of appropriate feed-in tariffs do not support feeding Into the grid.

However, besides price considerations, there remain many barriers to market penetration and development of the biogas sector:

- Lack of awareness of biogas opportunities
- High upfront costs for potential assessments and feasibility studies
- Lack of access to finance
- Lack of local capacity for project design, construction, operation and maintenance
- Legal framework conditions that complicate alternative energy production and Commercialization: for example, the right to sell electricity at local level has to be in Place.

As long as the national framework conditions are not favorable, electricity generation from biogas will remain limited to a few pilot applications. Clean biogas helps move towards low-carbon society.

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