

Use Of Biogas In Relevance To The Needs Of The Nigerian Society

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1.0 ABSTRACT

Sustainability in energy generation has been a major challenge in so many parts of the world. Nigeria, a country filled with over 170 million people is faced with several challenges such as; environmental pollutions from wastes, poor power supply, etc. According to *tandfonline*, the major energy source for this country lies in oil, hydropower and others which pose several effects in the environment. Even with these sources, power has never been sustainable. The major checkpoint of a developed economy is the power sector and in the bid to develop Nigeria's power sector, there must be a change in the strategy for Nigeria's power generation to increase. Today in Nigeria, we have electrical power of about 13,427MW installed and available capacity of 8,342MW [*FMIC press release, August 2019*]. In Europe, biogas power generation hits 17,272GWh a year. [*wiki, 27 May 2019*].

Research has it that a kilogram of organic waste can produce over 20 kilograms of methane gas. This gas can be used for cooking at a very affordable price as well as a means for power generation. It reduces the greenhouse effect, generates storable energy resources, has low operating costs and creates a massive decrease in electricity and tariff bills to mention but a few. It is expected that the reform process postulated by this paper would bring the desired growth and reformation to the Nation's power supply. The study analysis uses descriptive, statistical and reformative techniques duly constrained in this paper.

KEYWORDS: Biogas technology, renewable energy, green organic matter, bio digesters, alternative power stability

2.0 INTRODUCTION

Energy is the prime mover of economic growth [Smil & Knowland, 1980]. The habit of depending on one source has its disadvantages as it is becoming obvious in Nigeria today. To avoid the reoccurrence of the energy crisis of the early 1970s and late 1980s, developed countries have adopted alternative sources of energy and power generation through renewable energy sources. The objective of this paper is to look into biogas as an alternative renewable source of energy in Nigeria. Indeed, hydropower source of energy being adopted by Nigeria is truly considered to be the best, having an alternative source would be considered as an added advantage. China, a country having the world's largest capacity of hydropower generation of about 22,500MW was in 2017, one of the world-leading producers of biogas.

During the course of preparing this paper, statistical research was carried out on the final year projects awarded to students of science, Technology and Engineering courses in most Universities of Technology and Polytechnics. It was concluded that 87% of the projects given in institutions across Nigeria cuts across the adoption and construction of alternative sources of energy which may include biogas digesters and solar panels. This shows an increase in awareness and interest in the upgrade of the power sector in Nigeria.

It is interesting to know that statistically, biogas electricity production a year in Europe hits 17,272GWh [wiki, 27 May 2019]. According to bioenergy consults, hundreds of thousand kilograms of organic waste are deposited in Nigeria daily can be converted to meaningful energy.

These statistics alone is encouraging for a nation like Nigeria to develop interest as the rate of wastes which can, in turn, be of benefits to us is quite alarming. Furthermore, by 2022, the United States of America is expected to produce about 36billion gallons of biofuels annually [Molino et al., 2018]

3.0 BODY

Biogas is the mixture of gases such as methane, carbon dioxide, hydrogen sulphide and other traces of gases produced by the breakdown of organic matter and materials in the absence of oxygen and are used in the production of energy. It is a renewable source of energy produced biologically by fermentation anaerobically.

Biogas is primarily composed of 50-70% methane, 30-40% carbon dioxide and 2-8% traces amounts of hydrogen, carbon monoxide. Energy generated from biogas can be used directly for small purposes such as cooking and it can be used industrially in combustion engines to produce electricity, in the driving of turbines and other industrial purposes. Methane is the most important component in the constituent of biogas. Biogas is composed also of calories of about 6KWh/m^3 , this is also proven to be equivalent to half a litre of diesel

The organic matter used includes plant residue, animal waste and dung and other agricultural wastes. These have been identified and considered economically viable for the production of biogas [Akinbami et al., 1996]. Over the years, biogas has been considered an important source of clean energy and is therefore encouraged to be adopted in developing countries like Nigeria.

3.1 CHARACTERISTICS OF BIOGAS

Biogas is a colourless and odourless gas that burns with a blue flame similar to LPG and It contains little amount of impurities. Biogas is about 21% less dense than air. It has a calorific value of about 6KWh/m^3 and very high heating temperature.

3.2 METHODOLOGY [PRODUCTION PROCESS OF BIOGAS]

The processes involved in biogas production of energy from organic matter follows the same process of thermal energy generation from coal. The organic matter is crushed into smaller compositions to prepare it for the anaerobic digestion process. The manure and waste are mixed in the plant's receiving tank before undergoing complete heating of about $38\text{-}52^\circ\text{C}/100\text{-}125.6^\circ\text{F}$ after slurring.

Slurring organic matter means adding water to it to make the process easier and it is done in the mixing tank. It is then pumped into the digester in which the biogas is produced. The biomass stays in the digester for 2-3 weeks and the fermented slurry can also be used as crop fertilizer. The steam developed from the heating of the biomass might still contain impurities such as carbon dioxide, hence, it is upgraded by purification/gas cleaning. Soon after purification, it is sent into the boiler where the preheated air is burnt in the combustion zone to generate steam at high temperature and pressure.

Below is a chart illustrating the processes of the biogas plant

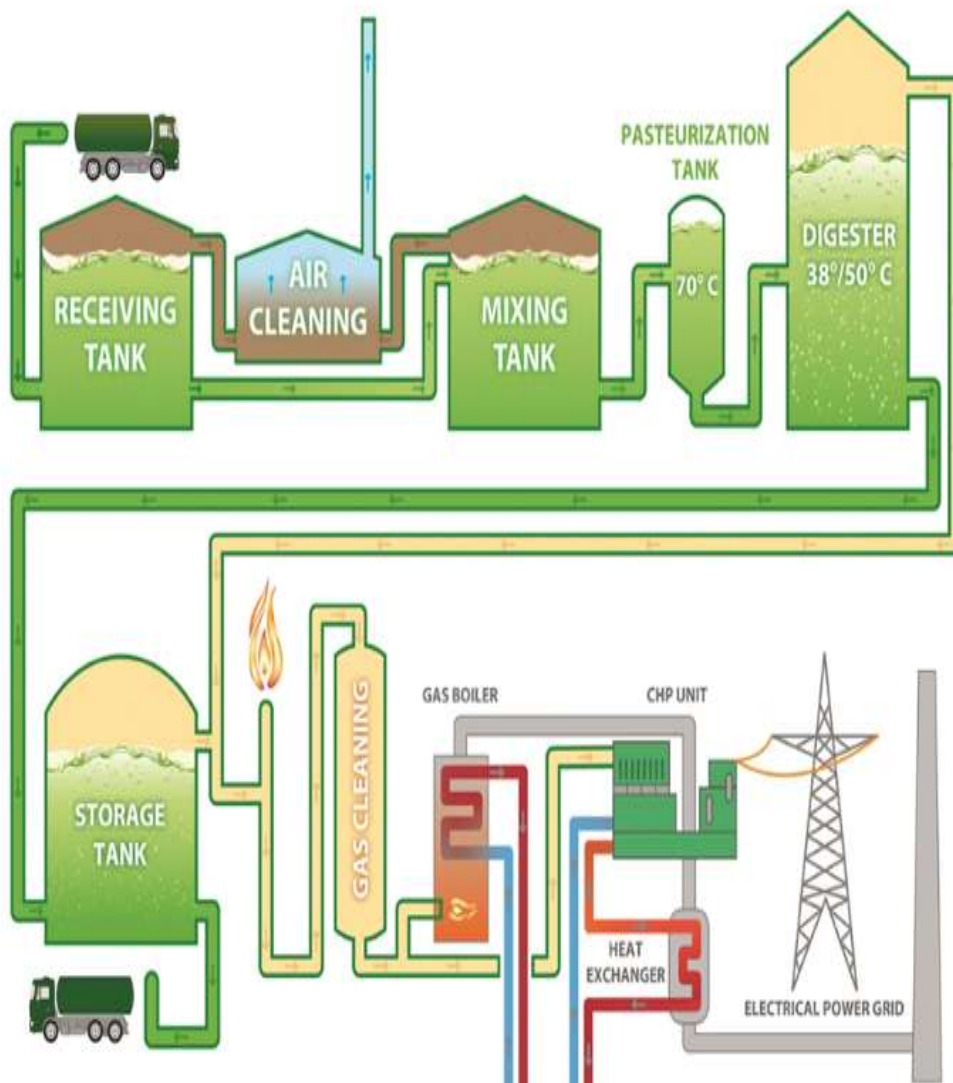


Figure 1: Biogas Process Illustration

The superheated steam is passed then into a steam turbine which is connected to the shaft on the alternator. The superheated steam possesses enough temperature and pressure to cause the rotation of the blades of the turbine. As the turbine rotates, the alternator also rotates thereby producing electrical energy. More so, biogas can also be utilized to generate electricity and heat in the plant's gas engine (CHP unit). The electricity is sent into the power grid and then used by the end-users

3.3 BIOGAS RISK AND SAFETY

Biogas production risk includes explosion, suffocation, asphyxiation, hydrogen sulphide choking and other health dangers and hazards. Extreme caution must be taken when working with biogas. Proper and standard safety measures, appropriate precautions, proper engineering controls and use of safety equipment's should be practised.

3.4 SIGNIFICANCE OF BIOGAS IN RELEVANCE TO THIS STUDY

The significance of this study is highlighted in the uses below;

1. It is used in the production of a renewable source of energy
2. Biogas reduces the greenhouse effect as there is a little or no need for fossil fuels
3. It serves as an alternative or additional power source and in turn, reduces over-dependence on the primary source of energy
4. Compared to Hydroelectric power, the production process does not need the high cost of transmission
5. Biogas also creates a source of income
6. Biogas produces cheap electricity for industrial and home use

7. There is a massive decrease in electricity bills and tariffs in areas where biogas is used

8. Away from the power sector, biogas also serves as a means of artificial fertilization as plants tend to easily absorb fermented slurry

3.5 GENERAL OVERVIEW ON THE RELEVANCE OF BIOGAS

An average Nigerian man spends about \$9 on biofuels {petrol and diesel} alone in a week because power itself is unstable. The rate at which diseases spread through pathogens and other factors is increasing by the day due to accumulated wastes. Biogas technology can, therefore, be seen as a medium by which these two distinct problems can be solved, more like a stone killing two birds. Biogas technology can be used as cooking fuel without air pollution and can be used for heating, lighting and electricity production [Bajgain et al., 2005]. Biogas constitutes a form of energy suitable for households and the agricultural and industrial sectors of the economy. It is a useful substitute for diesel, fuelwood, charcoal and kerosene; it reduces GHG emissions and it has no health risks because it burns clean [Akinbami et al., 2001]

Considering the total population of Nigeria, there tend to be so much waste disposed everyday also noting the fact that Nigeria is rich in these biomass resources which can be converted to energy; 228,400 tons of animal waste are produced per day, which if processed could yield 6.7 million cubic meters of biogas [Akinbami et al., 2001]

However, looking at the different statistics and referenced texts from well-known scholars, it can be said that this study if well utilized will fit well to solve and cater for the needs of the Nigerian society on whose page it lies on.

Nigeria is regarded and seen as the Giant of Africa but today we are looking at a Nigeria where international companies are folding up, even citizens prefer to go abroad to set up businesses but amidst other factors which may warrant this, the search for stable power may also be included in the factors. Recently, the Government's interest in stable power is increasing daily as more substations with higher transmission capacity have been constructed along Ogun, Abeokuta ways, Ikeja West among other regions in the country. Since we need to clap hands for

these improvements, there is also a need to throw a frown at the overdependence of one particular source of power.

According to the press release of FMIC, in August 2019, it was stated that over time, the power facilities became overloaded and could not cater to growing demands of power in Nigeria.

At the end of it all, we may regard power as a relevant need to the Nigerian society of which this paper has highlighted biogas technology as a measure to provide an alternative solution.

3.5 LIMITATION OF STUDY

1. In Nigeria today, the technological advancement systems are not up to standard compared to other developed nations.
2. There is so much dependence on hydropower generation and the use of fossil fuels
3. Lack of Government interest
4. It is so much limited to urban areas as they are mostly industrial areas and there are not so much green raw materials present
5. The high cost of construction and set up

4.0 CONCLUSION

As stated earlier in the abstract of this essay, it is expected that the reform process postulated by this paper would bring the desired growth and reformation to the Nation's power supply. Biogas has a lot of benefits as it helps us promote a green environment, considering the population of people in Nigeria, definitely, we tend to have a high amount of wastes and these wastes can be utilized to solve the needs of an alternative source for power

The generation and use of biogas will go a long way in achieving our dear country's dream of stable power which we have been craving for so long. Furthermore, it is expected that more research works into proper advancements and growth of the Nigerian society should be encouraged in different levels of learning institutions.

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