© 2020 IJSRST | Volume 5 | Issue 7 | Print ISSN : 2395-6011 | Online ISSN: 2395-602X

4th National Conference on Advances in Engineering and Applied Science
Organized by : Anjuman College of Engineering and Technology (ACET) Nagpur,
Maharashtra, India, In association with
International Journal of Scientific Research in Science and Technology

Energy Generation Through Bio-Gas

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ABSTRACT

Energy is essential for human development. Without any basic energy supply, people cannot cook food, lighting homes, or keep essential medication cooled. In recent years man's dependency on energy has increased rapidly mainly due to the rise within the living standards and use of advance technologies, in order that non-renewable fuel reserves being exhausted and there are issues related to their GHG (Green House Gas) emissions such as, carbon monoxide (CO), carbon dioxide (CO2), and methane (CH4), it has become essential to look forward the utilization of renewable or inexhaustible fuels to reduce the difficulty on our non-renewable fuels and for resolving the matter of emissions. Per capita energy consumption of India is declining with increasing its population, which has direct impact on economy. Biogas technology seems promising to achieve sustainable energy yields without damaging the environment. Waste management, manure creation, health care and employment foundation are the advantages of biogas system. Use of biogas assures renewable energy supply and balance of greenhouse gases. India is traditionally using biogas since while but there's got to improve the technology, applications and deployment strategies. Biogas derived from organic waste materials may be a promising alternative and renewable gaseous fuel for combustion (IC) engines and will substitute for conventional fossil fuels. The availability of electricity from renewable energy sources can provide basic energy services for promote local economic growth. The aims of this project is to generate power with the help of IC engine which runs on bio-waste such as animal dungs, vegetable waste, biomass etc

Keywords : Green House Gas, Carbon Monoxide, Carbon Dioxide, Methane, Biogas Technology

I. INTRODUCTION

Due to the increasing energy demand day by day within the numerous field like that trade, transportation, lighting, change of state etc .so that fuel resources inevitably necessitate for the simplest potential utilization of exhaustible fuel and non-renewable energy resources. nearly actually during this century, it's believed that rock oil merchandise and petroleum can become terribly restricted and expensive to seek out and manufacture. in step with the DOE our country foreign Brobdingnagian quantity of crude oils from gulf countries and costs area unit terribly fluctuant, hence, the general public interests area unit increasing within the field of varied various fuels (methanol, ethanol, biogas etc.) and biogas is one amongst the a lot of vital on the maarket sources to fulfil the energy demand. Biogas is just created by the method of anaerobic digestion or fermentation of perishable materials like biomass, manure, inexperienced waste (plants), municipal waste, house waste, crops and stuff. Biogas can even be cleansed and upgraded to fossil fuel standards and becomes bio paraffin (CH4).

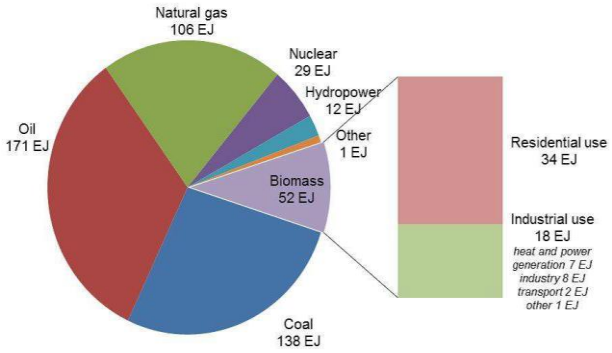

Figure: 1.1. Energy Generation from Different

What is Biogas?

Biogas is that the mixture of gases created by the breakdown of organic matter within the absence of chemical element (anaerobically), primarily consisting of methane series and CO2. Biogas is often created from raw materials like agricultural waste, manure, municipal waste, material, sewage, inexperienced waste or garbage. Biogas could be a renewable energy supply. In India, it's additionally called "Gobar Gas".

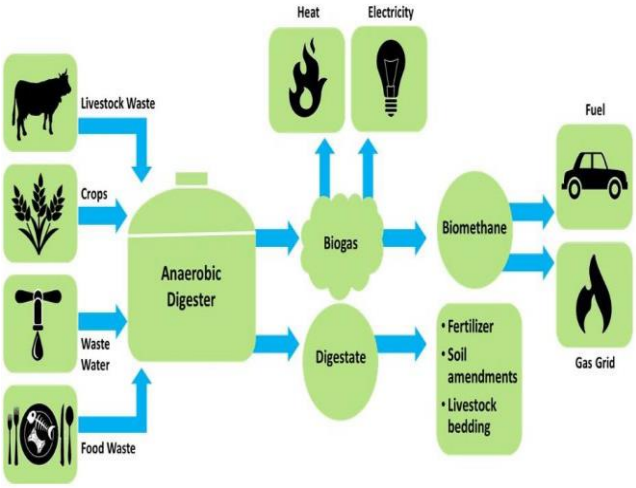

Figure: 1.2. Life cycle of Biogas production.

Biogas is one in every of the necessary renewable energy sources of the age and it offers the multiple benefits:

1. it's environmentally friendly and its combustion doesn't. Increase net quantity of greenhouse emission among the atmosphere.
2. it's created from waste biomass materials and thence ensures the most availableness.
3. It facilitates an improved approach of waste disposal together with a provision of energy provides.
4. It possesses the potential to exchange a considerable quantity of fossil fuels throughout the globe.
5. It provides a fashionable bio-fertilizer for agricultural lands, replace the utilization of chemical fertilizers for cultivation it can forestall deforestation particularly in developing countries.

Physical properties		Biogas components				Biogas (60% CH_4; 40% CO_2)
		CH_4	CO_2	H_2	H_2S	
volume fraction	%	55-70	27-44	1	3	100
calorific value	MJ/m^3	35,8	-	10,8	22,3	21,5
flash-point	°C	650-750	-	583	-	650-750
critical pressure	Mpa	4,7	7,5	1,3	89	7,5-8,9
critical temperature	°C	-82,5	31	-	100	-82,5
normal density	g/cm^3	0,72	1,98	0,09	1,54	1,2
critical density	g/cm^3	162	468	31	349	320
density ratio of air density	[-]	0,55	2,5	0,07	1,2	0,83

Table: 1.1 Physical Properties of Biogas

II. METHODS AND MATERIAL

The tests and analysis of engine performance characteristics, i.e., brake power (BP), brake thermal potency (BTE), brake specific fuel consumption (BSFC) and exhaust emission of biogas fuelled combustion engine are meted out. it's desired that the performance characteristics of biogas-fuelled engine should be studied for a large modification of engine speed and cargo. Then the results area unit compared with operation of the traditional gas fuels. Thus, the most objectives of this study area unit to judge the performance characteristics of biogas fuelled. I.C engine. For gas and biogas consumption by the engine,

all the parameters are recorded at completely different load on the engine. Moreover, time for fuel consumption by the engine is additionally noted to calculate the precise fuel consumption beneath varied conditions. to cut back the result of dispersion within the information, every set of experiment is recurrent by range of times

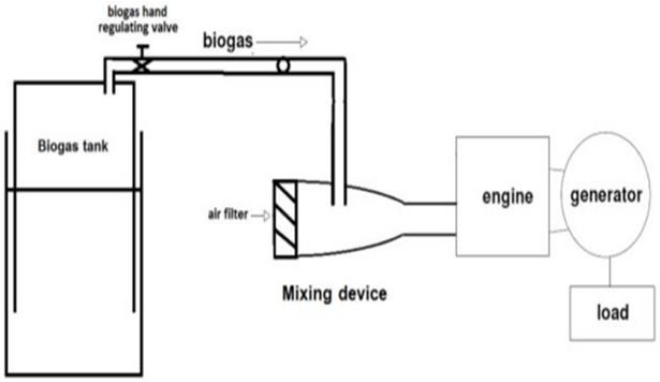

Figure: 2.1 Line Diagram of Proposed Biogas Plant

From these readings, the brake power, brake specific fuel consumption, brake thermal potency and exhaust emission area unit calculated...so as to judge the comparative performance characteristics of. I.C engine exploitation gas and biogas, the experiments are conducted by varied the load over a variety

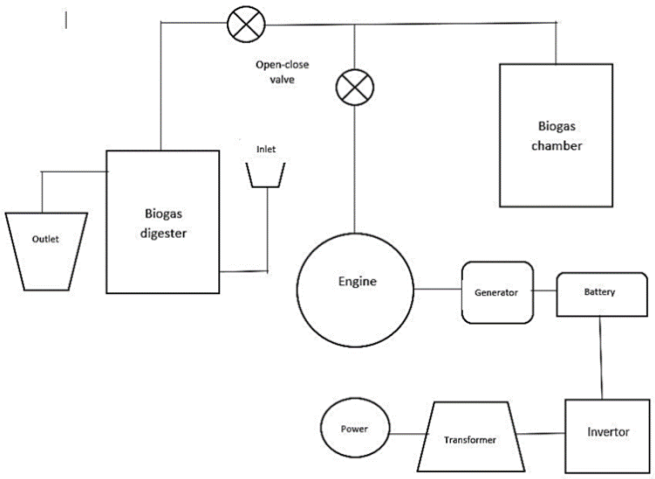

Figure: 3.2.1 Experimental Set-Up

III. Component Details

Anaerobic Digester :- Anaerobic digestion is that the method by that organic matter like animal or garbage is counteracted to supply biogas and biofertiliser. This method happens within the absence of gas in a very sealed, oxygen-free tank known as associate degree anaerobic steriliser .

It is 200litre industrial plastic barrels having one water with hooper for feeding stuff. One outlet for suspension and one outlet on prime facet of plastic barrels for grouping biogas.

Gas Storage Tank :- A biogas tank is usually a cylindrical formed unit made from a top quality tubes of torus-shaped balloons made up of associate water-repellent material, like soft, elastic caoutchouc, to stop air leak. Here a four wheeler tyre tube used as a gas collector.

Internal Combustion Engine :- An internal combustion engine (ICE) could be a engine within which the combustion of a fuel happens with associate degree oxidant (usually air) {in a|during a|in associate degree exceedingly|in a very} combustion chamber that's an integral a part of the operating fluid flow circuit. In an indoor combustion engine, the growth of the high-temperature and aggressive gases made by combustion applies direct force to some part of the engine..

The force is applied generally to pistons, rotary engine blades, rotor or a nozzle

Pressure Gauge:- A pressure gage may be a fluid intensity activity device. Pressure gauges area unit needed for the set-up and standardization of fluid power machines, and area unit indispensable in troubleshooting them. while not pressure gauges, fluid power systems would be each unpredictable and unreliable. Gauges facilitate to confirm there are not any leaks or pressure changes that might have an effect on the operative condition of the mechanism.

Brass Ball Valve:- The valve could be a full bore quarter flip valve for Associate in Nursing on/off application. It may be manual or automatic (electric or pneumatic).

the variability of seats and body materials permits it to reply to multiple applications within the business.

Brass Hose Nozzle:- A hose is a flexible hollow tube designed to carry fluids from one location to another. Hoses are also sometimes called pipes (the word pipe usually refers to a rigid tube, whereas a hose is usually a flexible one), or more generally tubing. The shape of a hose is usually cylindrical (having a circular cross section).

Brass Tee Joint:- Pipe Tee may be a variety of pipe fitting that is T-shaped having 2 shops, at 90° to the affiliation to the most line. it's a brief piece of pipe with a lateral outlet. Pipe Tee is employed to attach pipelines with a pipe at a right angle with the road. Pipe Tees area unit wide used as pipe fittings.

Geared Motor*:-* A gearmotor could be a homogenized and compact unit consisting of a gear unit and a motor. In electrical drive having 250W,13.7A,24V DC Power,2650rpm, it's additionally invariably an electrical motor.

IV. CALCULATION

PART: A

1. Total production of Biogas : 15 x 2 = 30 cubic meter.
2. Total gas production in cft. = 30 x 35.314 = 1059.42 cubic feet.
3. Dung that can be obtained from a single healthy Cow/buffalo= 15 Kgs.
4. Biogas that can be generated from each Kg of dung = 1.3cubic feet. Therefore no. of cattle required = (1059.42/15/1.3)= 55
5. Biogas required to run the above mentioned engine for 6hrs everyday = 15 x 5 x 6 = 450 cubic feet .The remaining biogas (1059.42-450 = 609.42 cubic feet) used to run the kiln/dryer, which in turn is used to bake the raw areca nut.
6. 1 cu. M of biogas can be replaced by 0.620 l of Kerosene (using standard replacement tables).
7. Saving in kerosene per day when biogas is use dinstead = 609.42/35.314x0.620 = 10.7l

PART:B

Payback period calculations

- ✓ Cost of Biogas plant setup = Rs. 30,000
- ✓ Cost of generator and related accessories = Rs. 20,000
- ✓ Total cost of set up = Rs 50,000.
- ✓ No. of units of electricity generated by generator set = 4.5 x 6 x 0.8 = 21.6 units Saving in the cost of electricity per day @ Rs. 3.5 per day= 21.6x3.5 = Rs. 75.6
- ✓ 5.Saving in the cost of Kerosene per day @ Rs. 5 per liter =10.7x5 = Rs. 53.5
- ✓ Income from bio manure per day from the biogas plant =Rs. 90
- ✓ Cost incurred in diesel consumption per day = 4x20 = Rs. 80
- ✓ Total payback period days = 50,000/(75.6+53.55+90-80) = 360 days = 1 year approx.

V. RESULTS AND CONCLUSION

A lot of prime quality sensible information and knowledge may be deduced from the elaborate and long term watching of a full scale analysis biogas plant. The study verified that long run measurements ar required to grasp the electrical power production and consumption of a biogas plant. as compared to recent literature, this study provides deeper insight into the electrical power consumption of specific shopper units by conjointly considering the biological parameters, like input materials and fermenter substrate characteristics. Over the year, the information showed a far better demand of power throughout the great and comfy summer months, as additional recooling of thermal power of the CHP unit is needed compared to winter times. A amendment within the offer of substrates mechanically affects the electrical power output of the CHP unit, however doesn't have an impression on auxiliary electrical energy demand. The bacterium react to changes of substrate offer, however a transpare. The weekly analysis of the zymosis substrate in each digesters showed most VFA results were below the detection limit and solely a number of among the vary of tolerance. further calculations of the input substrate degradability for the coverage amount verified a degradation rate on top of seventieth. Hence, each results make sure a awfully high edibility and stable and safe zymosis conditions for each digesters. A comparison of the electrical energy production and consumption for the complete BGP in 2010 and 2011 showed solely slight variations between the years. the electrical power consumption of the CHP is on the average 194 kWh/day and represents four.6% of the electrical power generated per day (during the amount lined by the study).

However, in method the number of consumption of energy will hardly be reduced. One improvement methodology is to extend the number of thermal power provided to the district heating plant of the farm and herewith cut back the operative length of emergency cooling pumps and fans. Moreover, the sort of the heating pumps might be turned into high energy potency pumps. the rise of energy potency, particularly of the agitation units, proves to be the most important challenge for plant operators. In follow, from a good vary of accessible mischief-maker sorts totally different combos ar put in within the digesters. this can be to avoid sinking and floating layers, for warmth and nutrient distribution and to modify gas carry at high DM contents. The challenge is to make sure an even digestate, though fibrous input substrates on one hand (with a bent to create floating layers), and fluids on the opposite hand got to be homogenized whereas the whole emulsion is subject to thixotropic conditions.

In this study, the biogas could be a renewable fuel which may be utilized in dual-fuel mode within the IC engine associate degree |with none} modification to an engine. additionally to straightforward convenience, it's renewable and low-cost. The biogas will build an honest substitute for IC Engine fuel. At equal power output state of affairs, the twin fuel engine performance is compared thereto of baseline case. during this found out, IC engine performance through an experiment investigated and therefore the following conclusions is also drawn:

Fig1. Energy generation through biogas (setup)

1) the employment of biogas in diesel engines, as in grouping fleets, besides reducing the consumption of IC Engine utilized in more or less twenty fifth, that finally ends up inflicting economic and environmental profit for the place within which it's used.
2) The existence of dioxide within the biogas reduced the burning rate, and thereby, deficient combustion that augmented the BSEC and exhaust gas temperature. yet as this, the longer pilot ignition delay and high self-ignition temperature of biogas helped delaying the twin fuel combustion method and offers to the additional enlargement stroke (end stroke). jointly of these factors ar to blame for down the thermal potency.
3) The Brake Thermal potency is cut because the share of biogas augmented as compared to standard fuel. this is often thanks to lower energy contents in IC Engine fuel with biogas.
4) it's examining that twin fuel mode want higher fuel energy (due to their poor combustion of fuel-air mixture and lower hot value) for manufacturing same quantity of shaft output compared to its diesel mode.

VI. Acknowledgements

We would like to thank our guide for all the guidance and knowledge provided during this project work. Apart from we would also thank our guide for the extended support during research paper writing.

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