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Study of Combined Renewable Power System for Electricity Generation

Durga Shanker Menaria [1], Surendra Verma[2]
Electrical Department[1], *E&C Department*[2]
Dungarpur College of Engg. Tech[1, 2]
Dungarpur (Raj.), RTU, Kota[1, 2]
durgeshm25@gmail.com[1], *er_suru@yahoo.co.in*[2]

Abstract- Global warming Earth's climate system and the continuous increase in the average temperature is clear. Effects of global warming, prosperity and economic and statistical effect on the form to overcome dependency. We have solar photovoltaic and biogas for electricity generation are starting a coalition system. If the energy system in a high reliability, cost effective and can be used to improve the quality of the small town. We will redesign the electrical system with environment friendly. We in India can be produced that will show the larger market. Large-scale, system independently a stationary power source for small towns and will provide daily gas alliance. To increase the efficiency of the system and to increase the use of renewable energy mix of the electricity system.

KEYWORDS: PV System, Bio Gas, Methane, I. C. Engine, Combined System.

1. INTRODUCTION

The combined power systems usually wind turbines or generators running on diesel or bio-fuels are a combination of photovoltaic with / biogas is used. During the day PV The power generated by the array is a power manager that controls the whole system, is stored in the battery bank through. The resulting combined system thus provides an optimal solution at a much lower price. It is ideal for electrification of remote villages in India. Non-renewable photovoltaic power generation serves to reduce fuel consumption.

Biogas is usually produced by the breakdown of organic matter in the absence of oxygen gases refers to the mix. Recycled waste such as biogas can be produced from raw materials available in the area. It is a renewable source of energy and in many cases exerts a much smaller carbon footprint.

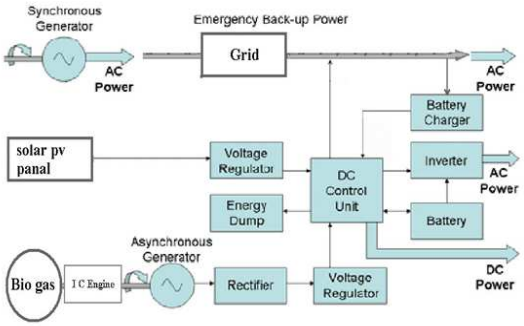

Fig.1.1 A Combined PV system

2. LITERATURE REVIEW

Several works are going on solar photovoltaic systems and biogas. Some of these are:

Janani Chakravarthi [1] presented a paper of biogas and energy production biogas.

Ajai Gupta, R. P. Saini, M. P. Sharma [2] presented a paper about Hybrid Energy System for Remote Area An Action Plan for Cost Effective Power Generation.

Vicente Salas and Emilio Olias [3] Hybrid Powering System for Stand-Alone Remote Telecom Applications.

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3. BIO GAS

Biogas etc. animal and human manure, leaves, twigs, grass, anaerobic fermentation of organic materials such as industrial waste gas produced by the mixture of methane, carbon dioxide, hydrogen and many other gases i.e. sulphids .

The presence of methane in biogas for cooking, lighting, and prime movers for power, which makes it suitable property lends combustion.

3.1 Working of Bio gas plant

Slurry (a mixture of equal amounts of biomass and water) is prepared in the mixing tank. Preparation of slurry inlet pipe through the digester is fed into the chamber. The plant is left unused for about two months and the introduction of slurry is stopped. During this period, anaerobic fermentation of biomass takes place in the presence of water and produces biogas digester. Biogas being lighter rises up and starts collecting in the gas holder. The gas holder is now starts moving. Gas holder can not rise beyond a certain level. Starts collecting more and more gas, more pressure to be exerted on the slurry begins. Spent slurry is forced into the chamber now shop from the top of the chamber. The chamber is filled with slurry store expenses, additional overflow tank is forced out through the outlet pipe. The later is used as fertilizer for plants. Biogas supply store to get gas from the gas valve is opened. Begins to produce biogas, gas cost a steady supply of fresh slurry and the introduction of slurry can be ensured by regular removal. [14]

Methane production: Airtightnees : The breakdown of organic material in the presence of oxygen to produce CO_2 and methane in the absence of it creates.

Temperature: Temperature for fermentation will be 35^oC-40^oC.

This stage may be represented by the following overall reaction:

Thought reaction of methane bacteria

$$nCH_{4+} (C_6H_{10}O_5)_n+H_2O \longrightarrow 3nCO_2$$

Individual reaction include:

1. Acid breakdown into methane

$$2C_3H_7COOH + H_2O \longrightarrow 5CH_4 + 3CO_2$$

2. Oxidation of ethanol by CO_2 to produce methane and acetic acid.

$$2C_3CH_2OH + CO_2 \longrightarrow 2CH_3COOH + CH_4$$

3. Reduction with hydrogen of carbon dioxide to produce methane

$$CO_2+4H_2 \longrightarrow CH_4 + 2H_2O$$

4. ECONOMIC AND STATISTICAL ANALYSIS

Financial study of a biogas plant: We based on our calculations take into account the increase in cost over the years has taken the following assumptions. We have raw materials like cow dung, human waste and organic waste are values that are almost negligible cost.

(1) Total no of families in the rural area =100 or 400 person and 1 LPG cylinder used in 1 month.

(2) Out of these 100 families 40 families have more than 5 members where as 40 have less than 4 members and 20 families have more than 2 members on an average.

(3) Cooking gas from plant will be sold at Rs 375 to single families per month.

(4) The compost manure produced will be sold at rate of Rs.530 per ton.

(5) Each family with more than 5 members requires 3.5 m^3 gas per day, families less than 4 members requires 2.8 m^3 of gas per day where as families of 2 or less requires 1.25 m^3 gas per day.

(6) We are analyzing for 2 biogas plants having combined capacity of 300 m^3 each.

(7) Manure produced will be 52.5 tones / month.

So gas required for all 100 families= (40x5) + (40x4) + (20x2) =400 member 280 m^3.

Our gas production is (300x2) =600 m^3

Total costs (Fixed + Variable) = Rs 24, 75,000+Rs 66,000+Rs 4,000=Rs 25, 45,000

Total revenues from used LPG = (100x325)x12=Rs 4,50,000 (save)

From selling manures = (52.5x12x530)=Rs 3,33,900

Total revenue per year=Rs 4,50,000 +Rs 3,33,900 =Rs 783900.

With a 3.7 year plant will run free of cost.

Money Requirement and Revenue Generation of Biogas Plant [9]

5. PROJECT MODEL

We have taken following assumptions for our calculations based on and taking into consideration the rise in costs over the years. We are assuming that the raw materials like cow dung.

1. Plant Capacity for Captive Power Generation
   300 M^3/day

2. Plant Model40 days HRT ,
   Vertical KVIC

3. Total no of families in the campus =100
   400 human

   1 LPG cylinder used in 1 month

4. 5 members requires 3.5 m^3gas per day[9]
3.5÷5=0.7m^3

400 person required gas per day
400×0.7=280m3

5. Total costs (Fixed + Variable) = Rs 2400000 + Rs 75,000+Rs 66,000+Rs 4,000=Rs 25, 45,000

6. Total cost of the project
Rs. 25,45,000.00

7. SAVINGS:

- Cooking gas from plant will be sold at Rs 375
100 cylinder x Rs.375
to single families, per month
=Rs.37500
12 months 32500×12
= Rs 4,50,000
Manure sale/use per year @ Rs. 530/ ton
630 x Rs. 500.00=Rs.3,33,900
- Net savings /year
Rs 4,50,000+ Rs.3,33,900=Rs 7,83,900

- Pay Back
43 Months or 3 year 7 months

Money Requirement and Revenue Generation of Biogas Plant [9]

6. PHOTOVOLTAIC SYSTEM

Photovoltaic is the direct conversion of light into electricity at the atomic level. Some materials absorb photons of light and release electrons that causes them to exhibit a property known as the photoelectric effect. These free electrons that electric current can be used as power results are captured. Photoelectric effect when first exposed to light certain materials would produce small amounts of electric current was found that in 1839 a French physicist, Edmund Becquerel, was noted by. In 1905, Albert Einstein nature of light and he later won the Nobel Prize in physics for which the photoelectric effect on which photovoltaic technology is based, is described. The first photovoltaic module was built by Bell Laboratories in 1954.

It was billed as a solar battery and was mostly just a eagerness as it was too expensive to gain widespread use. In the 1960s, the space industry technology to provide power aboard spacecraft first started to make serious use. Through the space programs, the technology was established its reliability, advanced, and began to decline in cost. During the energy crisis in the 1970s, photovoltaic technology as a source of power for non-space applications recognized. The picture above shows the operation of a basic photovoltaic cell, also called a solar cell.

Semiconductor materials such as silicon solar cells of the same type used in the microelectronics industry, are made of. For solar cells, a thin semiconductor wafer especially on one side positive and the other negative an electric field, is used to form.

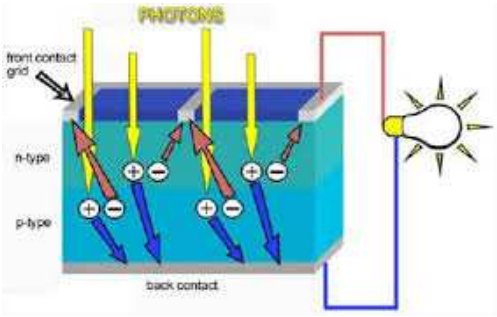

Fig. (1.2)Working principle of a PV cell

Light energy strikes the solar cell, electrons are knocked loose from the atoms in the semiconductor material. Electrical conductor to an electrical circuit, are attached to the positive and negative sides, that an electric current of electrons, can be taken as electricity. This electricity can then be used to power a load. A PV system consists of many components. These include solar cells, mechanical and electrical connections and mountings and means of regulating or modifying the electrical output.

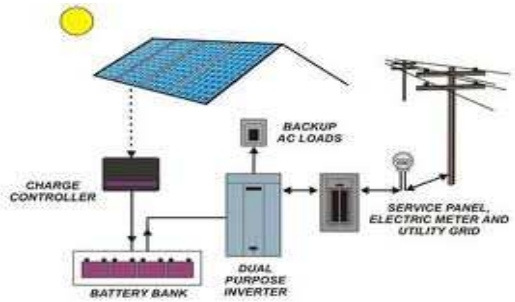

Fig. (1.3) A simple PV system

Due to the low voltage of an individual solar cell, multiple cells are then linked together into a photovoltaic array photovoltaic modules (solar panels usually called), are combined. Electricity generated, stored or used directly can be fed into a large electricity grid. Create a joint system for a PV system can be combined with domestic power generators.

Solar power generation from solar radiation is taken into account. PV module efficiency of 14.3% is considered. The combined power system is completely used up for energy resources and healthy environment which gives a system. There are manifold benefits of biogas.

7. BIOGAS POWER GENERATION

Running I.C. Engines: Diesel Engines: Use of biogas in diesel engines in limited to the stationary engine since (gas pressure is slightly above atmospheric pressure and cannot be transported to long distances. Existing diesel engines can be modified to

run on dual fuel while still retaining the ability to use diesel fuel only [11].

The following points should be considered while modifying the diesel engine:

- Compression ratio: Original compression ration should be retained, and advance injection angle should not be charged to ensure normal running of the engine on dual fuel and diesel and also facilities maintenance and repair.
- Modification of the intake: To provide biogas after the air filters into the inlet pipe, the intake should be modified. Some of the designs suggested for the introduction of biogas into the intake are shown below.

In order to give the proper biogas/air mixture gas inlet devices are designed to suit different engine designs and inlet pipes.

Project models for power generation

Project model-1

Biogas based Electricity Generation cum Composting (by NADEP method) can be installed and commissioned based on about 150–200cattle, 3000 human waste [9].

1. Salient features of the project are as follows**:** Power generation from human waste.

SR.NO. ITEM DETAILS

1. Plant Capacity for Captive Power Generation
   85 M^3/day
2. Plant Model
   40 days HRT , Vertical KVIC
3. Daily human waste requirement for the plants
   3000 human waste
4. Human waste of 200 person produce 5 m^3 [10]
   Producing of biogas by per person
   5÷200 =0.025 m^3
   3000 human waste is produce
   3000×0.025=75 m^3
5. 5m^3 biogas generate 12 kwhr [10]
   Generation of per m^3
   12÷5 =2.4 kwhr
   75m3 biogas generate
   75x2.4 =180kwhr
6. Total cost of the project
   Rs. 20, 00,000.00
7. Recurring expenditure /annum (A)
   Rs. 1, 20,000
8. SAVINGS :

As electricity bill per year @ Rs. 4.50/unit (B)
65,000 units XRs.4.50 =Rs.2,92,500
Manure sale/use per year @ Rs. 530/ ton (C)
450 x Rs. 530=Rs.2,38,500
Net savings /year =[(B+C)-A]
Rs.4,11,000
Pay Back
55Months or 4 year 8 months Approximate

Project model-2 Salient features of the project are as follows: Power generation from cattle waste.

SR.NO. ITEM DETAILS

1. Plant Capacity for Captive Power Generation -
   85 M^3/day
2. Plant Model - 40 days HRT , Vertical KVIC
3. Daily cattle waste requirement for the plants
   150-200 cattle waste
4. Cattle waste of 200 cattle produce 7.2 m^3
   7.2÷200 =0.036 m^3

Producing of biogas by per cattle is produce
2100 kg x 0.036=75 m^3
5.5m^3 biogas generate 12 kwhr [10]
12 ÷ 5 =2.4 kwhr
Generation of per m^3- 75m^3 biogas generate
75 x 2.4 =180 kwhr

6. Total cost of the project
   Rs. 20, 00,000.00
7. Recurring expenditure /annum(A)
   Rs. 1, 20,000.00
8. SAVINGS :

As electricity bill per year @ Rs. 4.50/unit(B)
65,000units x Rs.4.50 =Rs.2,92,500
Manure sale/use per year @ Rs. 530/ ton(C)
850 x Rs. 530=Rs.4,50,500
Net savings /year =[(B+C)-A]
Rs.5,65,000.00
Pay Back
48Months or 4year8months Approximate

Let the Approximate demand of one day 1336 Kwh/day of connected consumers.

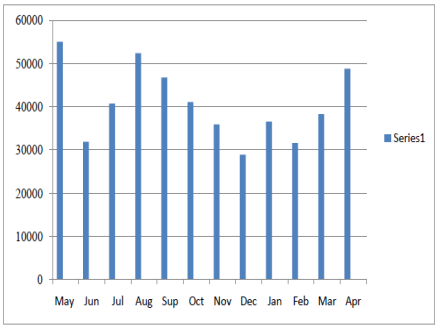

Fig. 1.1 the bar chart electricity consumption in main substation between May 2011 to April 2012 and take approximate value due to correct data error.

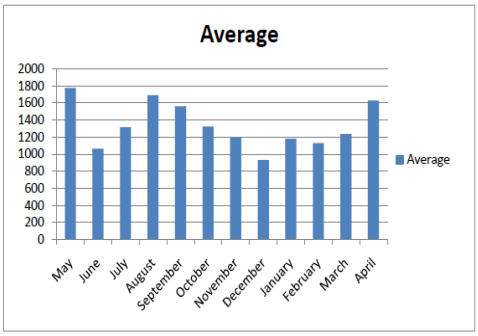

Fig 1.2 Average electricity consumption of the month.

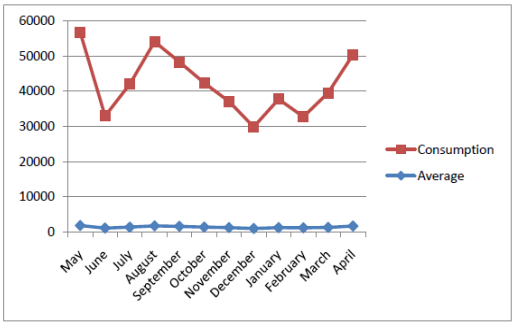

Fig 1.3 Average of the month with consumption of electricity.

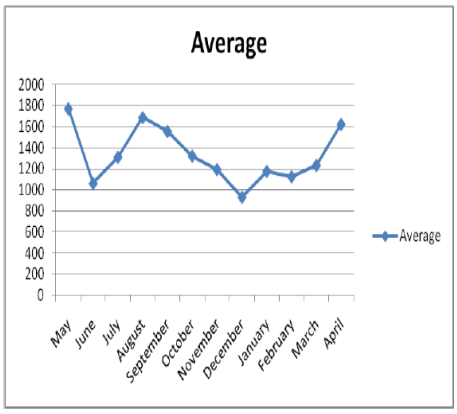

Fig 1.4 Max and min electricity consumption of months.

8. SOLAR-BIOGAS COMBINED POWER GENERATION

Combination with biogas generation solar generation. Output is stored in the battery bank. This power inverter converts DC power into AC power, is drawn through the electrical load. Inverter short circuit, overheating, low battery voltage and has built-in protection against overload. Depending on the need of the battery bank system, a certain number of days with no biogas is designed to feed the load.

All installation of photovoltaic solar panels to power source. Photovoltaic (PV) produce electricity when exposed to light in the solid state, type of semi-conductor devices. The term photovoltaic actually "means electricity from light." An example of this phenomenon would Calculators several hand-held power went off the room light. The technology for large power applications are also possible.

Prime over system is running by I.C. Engines use of biogas in diesel engines. Existing diesel engines can be modified to run on dual fuel while still retaining the ability to use diesel fuel only, Petrol engines: These engines can run on 100% biogas.

Biogas is a type of gas that is formed by the biological breakdown of organic matter in an oxygen deficient environment. It is counted as an eco-friendly bio-fuel. Biogas contains 60% methane and carbon dioxide. It can be employed for generating electricity and also as automotive fuel. Biogas can be used as a substitute for compressed natural gas (CNG) or liquid petroleum gas (LPG).

Biogas power plant are produce following generation;-

Plant 1 is produce power generation 180 Kwh/Day

Plant 2 to produce max power generation 180 Kwh/Day

Total power generation 360 Kwh/Day

Solar power plant are produce following generation;-

The efficiency of the PV modules is considered to be 14.3%. The radiation data for the month of April has been taken as a sample.

The roof top PV systems will be considered in the different places of rural areas and total generated power is not fulfill the demand of one day 1336 Kwh/day so we are connect grid but some load sharing which is use full to reduce load from grid.

9. CONCLUSION

Meet with locally available renewable energy sources could supplement the energy needs of the people who promote efficient technologies. We will independently provide a stable power source solar / biogas are trying to develop a joint system. Biogas and solar energy combined system independently will provide a stable power source. We combined system for power generation are trying to evaluate the economic. Larger biogas plants generate and feed electricity into the power grid mainstream. Small biogas production units can support lighting and cooking needs.

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