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Review on Solar Biomass Hybrid System

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ABSTRACT: Day by day energy need is increasing tremendously and the fuel resources are getting exhausted and most of the energy produced being utilized in the urban areas so the electricity need for rural areas are not fulfilled in most of the developing countries including India. So, in order to fulfil the energy requirement there is a necessity to switch to renewable resources, and in rural areas biomass and solar energy are in abundance. Hence we can utilize a hybrid plant implementing solar and biomass to fulfil the energy need of rural areas.

KEYWORDS*:* Biomass, Solar PV, Hybrid System, HOMER.

I. INTRODUCTION

Energy is one of the basic needs to improve poverty and socioeconomic advancement. Animal waste and solar radiations are two renewable energy resources that are richly available in rural areas of developing countries. Biomasses produced from natural resources forest crops are still the main source of energy in many communities in the developing countries of the world. The absence of recent techniques, in terms of energy conversion and the lack of resource planning, creating a great trouble on the environment, in terms of deforestation as well as the polluting emission waste produced by the combustion of such fuels. Renewable energy systems have been utilized in many cases to lower down these problems. Although it is not sufficient for these two resources independently to meet both thermal as well as electricity needs. To make this possible integration of these two resources in rural energy planning, it is required to evaluate their economic virtues, and consider their capacity to deal with the demands. As India is an agricultural based country, availability of biomass resources is sufficient and there is a good scope of solar energy. The present paper introduces the perception of an alternative Hybrid Power System configuration that combines photovoltaic modules and bio digesters fuelled by Agricultural waste as the basis for rural development. Attention is drawn to the BARWANI district of Madhya Pradesh.

II. HYBRID SYSTEM

The hybrid system consists of electric loads, biomass resources, solar resources and system components such as PV, generator, battery, and converter [3].

Electric Load

In this study, we have considered a community with 100 households and 10 shops. The load is based on 3 energy efficient lamps (15 W each), on an average one 100 W ceiling fan , and 1 television (70 W) for each family and 2 energy efficient lamps (15 W each), 1 fan (100 W) and overall 2 refrigerators (1.2 kWh/day each) for shops. Also, 5 refrigerators (1.2 kWh/day each) and 5 pumps (150 W each) are considered among the residential. Figure-1 represents the daily load from November to February and Figure-2 contains the daily load profile from March to October.

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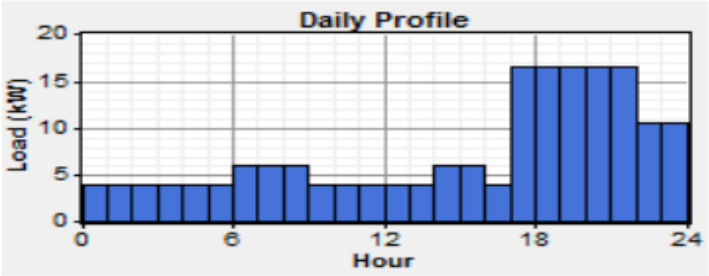

Fig 1. Load profile of a day (November-February)

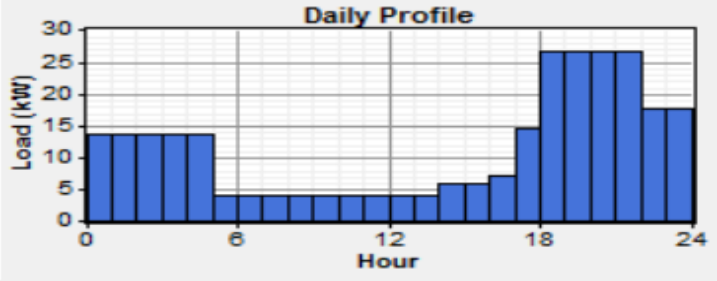

Fig 2. Load profile of a day (March-October)

III. RENEWABLE ENERGY RESOURCES

Solar PV

Sun is the major source of energy. Solar energy is renewable, inexhaustible and environmental friendly. large amount of sunshine is available in India all the year with an average sun power of 490W/m2/day. Battery systems charged with solar power provide power supply for complete 24hours a day. Sun energy is converted directly into D C electricity with the help of PV cells. Semiconductor materials are used to make this solar cell in PV module. Electricity generated from PV cell can be used to power a load or can be stored in a battery. solar systems generally can be much cheaper especially to remote areas.

Solar data at Barwani in India is presented graphically by using HOMER software in Fig 3. Homer use the solar resources input to calculate the PV array power And, the solar data is obtained by putting the longitudinal and latitudinal value in HOMER software.

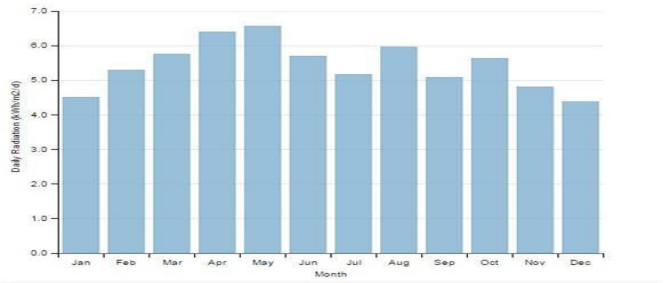

Fig 3: Solar Radiation data throughout the year

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Biomass

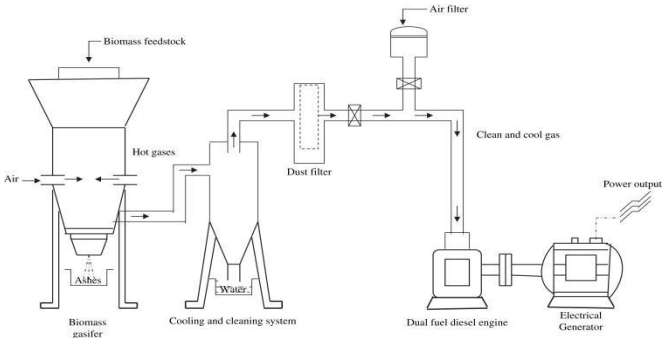

Fig: 4 Biomass gasifier plant

Biomass is the most interesting and emerging option to supply future energy demands. Though all biomass can be used to generate electricity, a small fraction of it can be utilized to produce substantial amount of energy. Still the energy efficiency of this technology is limited and high operating and investment costs, leading in low financial returns. Biomass power plants have capacities typically ranging between 2-50 MW. Larger plants benefit from comparatively higher energy efficiencies (usually up to 22-23 %) but have to face the challenge of meeting a demand for sufficient amounts of biomass, as the resource is characterized for its increasing scarcity, high cost and seasonality. The particles size of biomass ranges varies from 5 cm to few mm. Feedstock should preferably be free due to the heat needed to vaporize the water within the particle; however maximum moisture content up to 30% to 50% were mentioned as suitable.

Gasification

Gasification of biomass has been known as one of the effective technology options for the utilization of this renewable energy resource. The process of converting solid fuels into a combustible gas mixture with a controlled amount of oxygen and/or steam is called gasification; this is accomplished by reaction of the material at high temperature (more than 7000c). The resulting gas mixture is called syngas or producer gas. Power delivered from gasification of biomass and combustion of the resultant gas is considered to be a source of renewable energy. The calorific value of this gas varies between 4.0 and 6.0 MJ/Nm^3 and about 10 to 15 percent of the heating value of natural gas. The process of generation of electricity from biomass is illustrates in Figure 5.

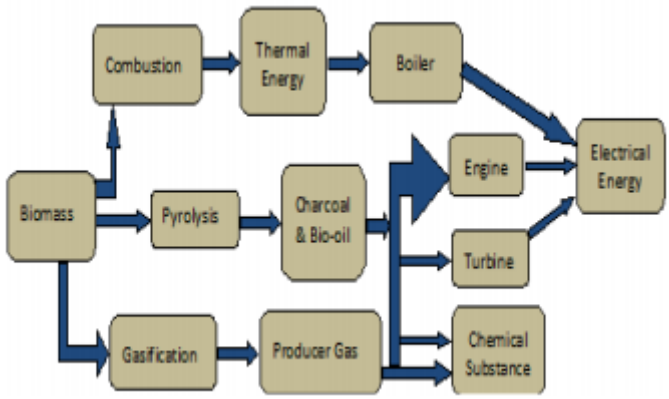

Fig 5. Biomass Conversion into Energy

The three various stages of gasification process are:

1) Gasification process starts with auto thermal heating of the reaction mixture.
2) Secondly, combustion gases are pyrolysis by being passed through a bed of fuel at high temperature.

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3) Primary products of combustion, $CO_2$and H_2O are reconverted by reduction reaction to carbon monoxide, hydrogen and methane.

IV. SYSTEM COMPONENTS

In this analysis, the major components are PV panels, bio gasifier, bio fuel generators, batteries, and converters. For economic analysis, the number of components, capital cost, replacement and O&M costs and operating hours to be defined in HOMER in order to simulate the system.

Solar Photovoltaic
PV cells are used to generate electrical energy by converting solar radiation into direct current electricity using semiconductors that exhibit the photovoltaic effect. The photovoltaic power generation employs solar panels composed of a number of solar cells containing a photovoltaic component. Materials presently used for photovoltaics include monocrystalline, polycrystalline, amorphous silicon, copper indium gallium selenide/sulfide and cadmium telluride.

Generator
The main reason of using to fulfill the energy demand in peak hour both for winter and summer season and also meet the terms of backup requirements. Since biomass resource is available in abundance, fuel cost is considered nil. Major cost is considered for biogas generation procedure and biogas power generator.

Battery
Batteries are used to store the solar photovoltaic output. In many rural area like we proposed, where most of the power is used after day time. So, principal target of our system is to store energy at day time and discharge the stored energy after evening. Hence, batteries are used following through charge controller. a dump load is also used for the purpose of removing excess charge and preventing system damage.

Converter
Converter converts the dc power to ac power. Since, most of the home appliances are operated in ac; dc generation from the PV array is converted to ac following through a controller.

V. CONCLUSION

India is running in the power shortage circumstance and socio-economic development is also responsible for power crisis. Huge difference is created in the educational level of rural and urban areas because of lack of electricity which in terms keeps the peoples of rural areas away from main stream of development.
In this paper for electrification of rural area, Barwani district of Madhya Pradesh is selected. Potential of solar and biomass is analyzed. afterward, base on this potential, a practicability study for a model community of 100 families and 10 shops has been conducted. The optimize hybrid system was developed considering manufacturing cost and efficiency.

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