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Modulated Power Output by Multi-hybrid Renewable Energy Source based on Solar, Wind and Biogas

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Abstract: *The Hybrid renewable energy generation systems focusing on energy sustainability and its utilization using solar PV, wind and biogas energy sources. A hybrid energy system, consists of two or more renewable energy sources used together to generate the power. The hybrid renewable energy sources consists of different sources, such as Solar PV (photovoltaic), wind, biomass, geothermal and tides, ocean waves etc. which are used to generate power. In other word it can defined as "Energy system which is designed to extract power by using two or more energy sources is called as the hybrid energy system." Hybrid energy system has good reliability, efficiency, less emission, and lower cost.*

The important challenges in the design and energy utilization of hybrid energy systems. Hybrid stand-alone DG system comprising solar panel, Wind turbine and biogas. The power available from PV and WT feeds the load, and when there is power deficit, the power deficit controller combination turns the gas into electric power and serves the load demand. Simulations have been performed in MATLAB Simulink Software.

Index Terms*: - Hybrid Energy, Non-Conventional, Renewable Systems, Utilization, Environment, Efficiency.*

INTRODUCTION

Hybrid systems are usually a combination of photovoltaic with wind turbines and/or generators running on diesel or bio fuels/biogas is also used. Power generated by the PV array during the day is stored in the battery bank through an energy manager, which controls the complete system. Diesel generators are expensive to run, and may also require frequent maintenance support. A judicious mix of solar and other renewable technologies, coupled with a diesel generator / grid, can offer a techno-commercially viable solution that will power the backbone of rural connectivity. The resultant hybrid system thus offers an optimal solution at a substantially lower cost. It is ideal for electrification of remote villages in India. Cutting edge technologies based on latest research to integrate dual power sources in the most ideal

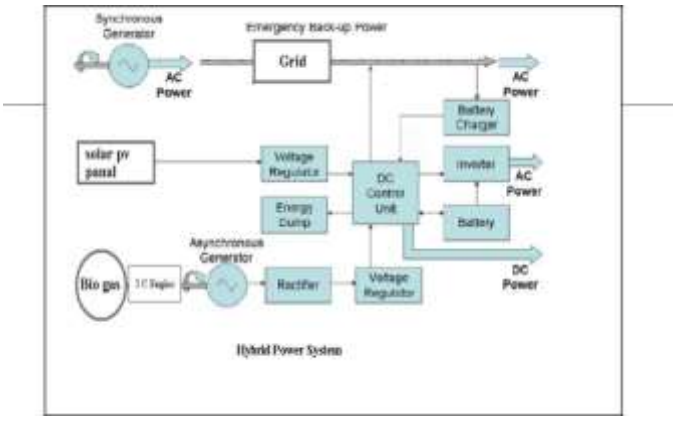

Fig 1.1 A Hybrid PV System

The solar generation is combining with biogas generation. The output is stored in the battery bank. This energy is drawn by the electrical loads through the inverter, which converts DC power into AC power. The inverter has in-built protection against short-circuit, overheating, low battery voltage and overload. The battery bank is designed to feed the loads up to a certain number of days with no sun or wind/biogas, depending upon the system requirement.

The solar panel is the power source of all photovoltaic installation. Photovoltaic (PV) are solid-state, semi-conductor type devices that produce electricity when exposed to light. The word photovoltaic actually means "electricity from light." Many hand-held calculators run off power from room light, which would be one example of this phenomenon. Larger power applications for this technology 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).

How does it works?

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1. Multi Hybrid Renewable Energy Systems

Multi Hybrid renewable energy systems are becoming popular as stand-alone power systems for providing electricity in remote areas due to advances in renewable energy technologies and subsequent rise in prices of petroleum products. A hybrid energy system, usually consists of two or more renewable energy sources used together to generate the power. Completely renewable hybrid power plant consists of sources such as solar, wind, biomass, hydro, ocean waves and tides etc. A hybrid power plant consisting of these four renewable energy sources can be made into operation by proper utilization of these sources in a completely controlled manner. Review of hybrid renewable energy systems focusing on energy sustainability is reported. Electricity is most needed for our day to day life.

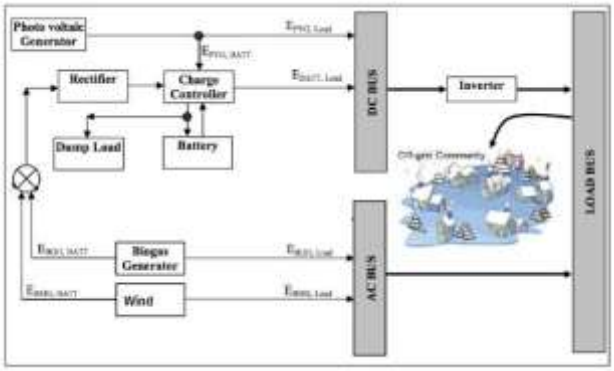
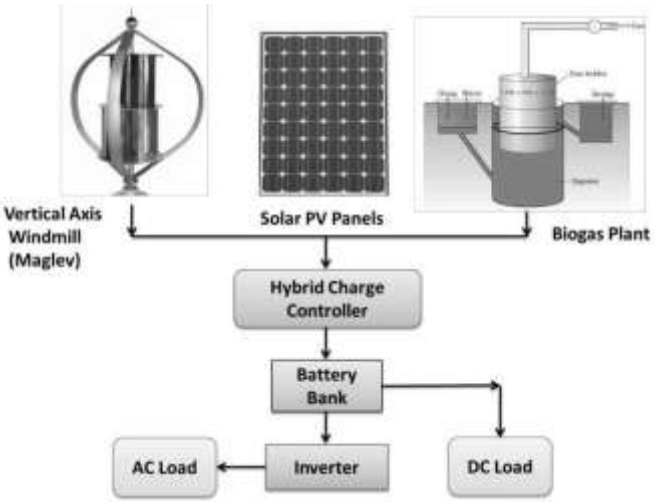


Figure: 1.2 Configuration of Multi-Hybrid Energy System

Modelling of the Hybrid PV/Wind /Biomass System

Modelisation is an essential step before any phase of optimal sizing for a hybrid PV/wind system with storage battery, as shown in Figure 4.1 three principal subsystems are included, the PV generator, the wind turbine and the biomass. A methodology for modelling HPWS components is described below.



Block diagram of Hybrid Renewable Energy System related to

2. Solar PV Cell

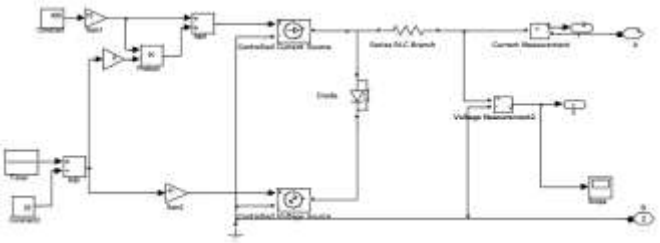


Figure: 1.3 Simulating diagram of Solar PV Cell Modeling of The Hybrid PV/Wind /Biomass System

3. Modelling of Biomass System

Kind of biomass energy with low heat value (such as waste from agriculture and forest and organic waste) into combustible gas and then feeds this gas to a generator for electricity generation. Discovering the method of biomass gasification for electricity generation can solve both problems of effective use of renewable energy and environmental pollution from organic waste. For this reason, the technology of biomass gasification for electricity generation attracts more and more research as well as applications. The modelling equation 1. and 2 for the bioreactor is

where the state variables are x = biomass (cell) concentration = mass of cells/volume, and x = substrate concentration = mass of substrate/volume. The manipulated input is D = dilution rate = F/V = volumetric flow rate/reactor volume.

The direct combustion of biomass is evolved in steps and the functions performed by the different units are –

1. Storage - The biomass material including the agricultural wastes like paddy husk, paddy straw, wheat husk and wheat straw etc are stored in

storage unit where it is saved and is supplied as a fuel to carry the combustion process.

2. Preparation and processing unit - The biomass stored is then converted into simpler substances in the preparation and processing unit and is then fed to the boiler.

3. Boiler - Biomass is used as raw material or fuel in the boiler. The steam is generated due to the burning of raw material and is then fed to steam turbine.

4. Steam Turbine - The steam generated after the burning of raw material is sufficient to run the turbine. The steam energy is converted into electrical energy and thus the output is received from the turbine

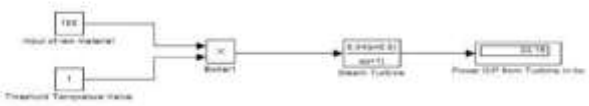


Figure: 1.4 Simulink Model of Standalone Biomass Plant

Solar PV Cell

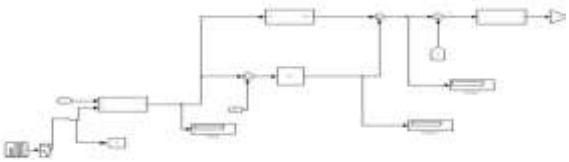


Figure:1.5 Simulating diagram of Solar PV Cell

5. Biogas Generator

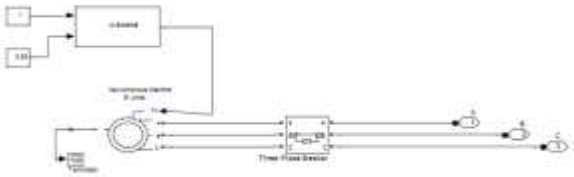


Figure: 1.6 Simulating diagram of Biomass Generator

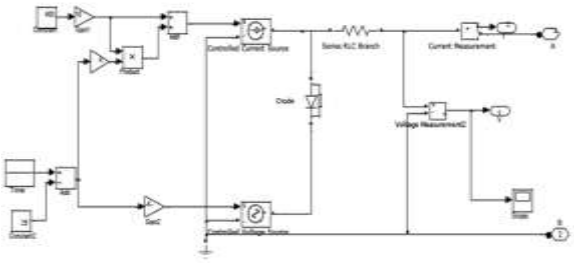


Figure: 1.8 Simulating diagram of Biomass Generator

In Figure 1.9 show Grid voltage & current, as load is resistive we are not observe any harmonic across grid.

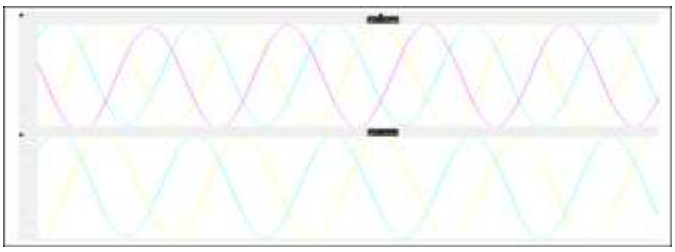


Figure: 1.9 Waveform of Grid Voltage and Grid Current

In Figure 1.10 Show voltage across Wind generator, from the present waveform we observed that as wind generator has rotating part we get 1.5e4 output across generator.

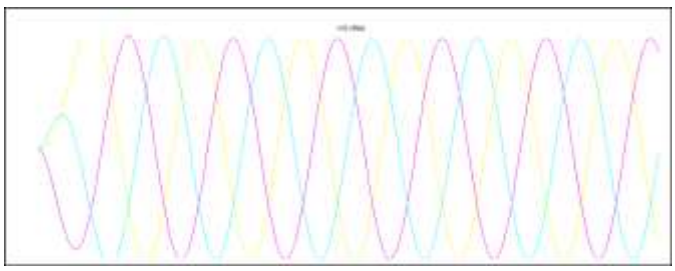


Figure: 1.10 Waveform of Wind Voltage

In Figure 1.11 show current across Wind generator, from the present waveform we observed that as wind generator has rotating part we get 40A output across generator.

Figure: 1.11 Waveform of Wind Current

As the biomass output is also ac, because of rotating turbine, from figure 6.4 shows that voltage is depend on ratio of heating.

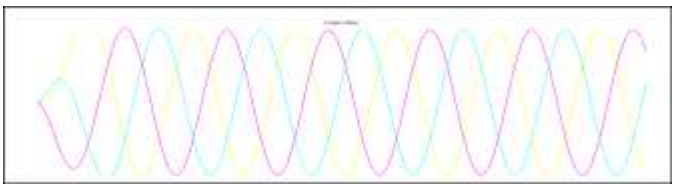


Figure: 1.12 Waveform of Biomass Voltage

Conclusion

Hybrid renewable energy generation based on Solar PV, Wind and Biogas Plant. Here we have discussed work reported on hybrid renewable energy systems and their associated controls based on the survey of available literature. Because the peak operating times for wind and solar systems occur at different times of the day and year, hybrid systems are more likely to produce power when you need. It. According to many renewable energy experts, a small "hybrid" electric system that combines wind, solar PV (photovoltaic) and biogas technologies offers several advantages over either single system. Added advantage of hybrid system is that they produce clean energy. Thus hybrid energy systems will meet the need of alternate energy sources in most effective, efficient and economical means.

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