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# Multi-hybrid Renewable Energy Source Based on Solar, Wind and Biogas Plants

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***Abstract:*** *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.*

*A Hybrid model of a solar / wind and fuel cell in Simulink, a high efficient hybrid model is developed and is compared with the hybrid model which is using battery as its storage system instead of fuel cells. A comparative study of hybrid model of solar /wind and fuel cells system has been made. . A stand alone renewable energy based power supply system consisting of aqua electrolyses, fuel cell generators, wind turbine generators and diesel generators in isolated small islands is simulated. The total output power meets the total load demand, no separate batteries are required and the system efficiency is improved.*

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

### 1.1 INTRODUCTION

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.

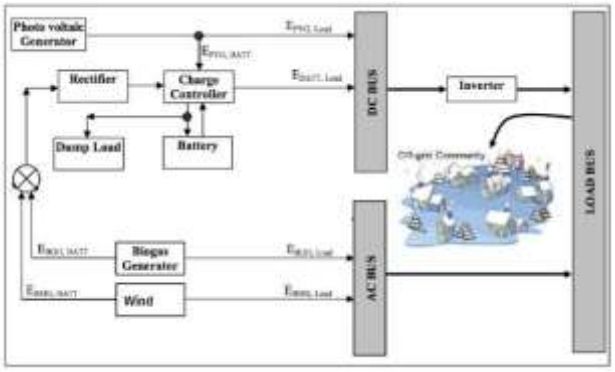


Figure: 1.1 Configuration of Multi-Hybrid Energy System

### 1.2 Solar Grid Tie Systems

Solar off grid & cabin system: - A PVS consists of many components. These include solar cells, mechanical and electrical connections and mountings and means of regulating and/or modifying the electrical output. Due to the low voltage of an individual solar cell, several cells are combined into photovoltaic modules (commonly called solar panels), which are then connected together into a photovoltaic array. The electricity generated can be used directly, stored or fed into a large electricity grid. A PVS may also be combined with domestic electricity generators to create a hybrid system. A photovoltaic system is generally designed in order to ensure the highest energy yield for a given investment.

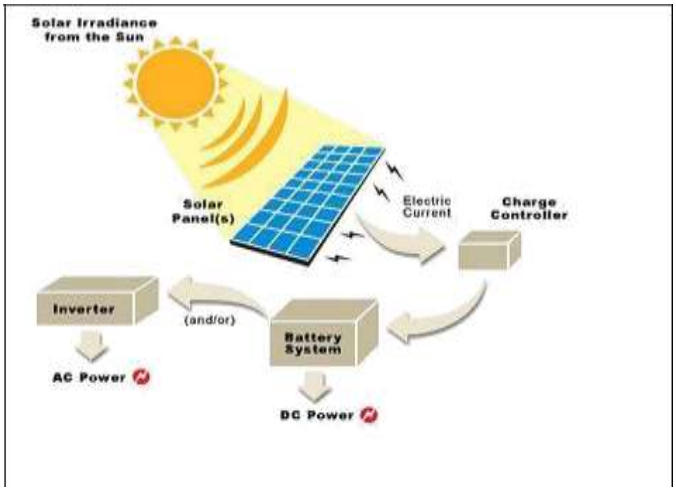


Figure: 1.2 A Simple PV System

### 1.3 Terawatt Challenge

15 TW was the mean total world energy power need during 2005. See The Terawatt Challenge for further information. Space based solar power can provide access to yet much more energy. 10kW/person is the mean power (total - electricity, transportation, heating) used in the developed world. Total Surface Area Required to Fuel the World with Solar energy production with: photovoltaic panels, free piston Stirling generator, batteries producing hydrogen direct hydrogen producing photovoltaic. Average solar irradiance, watts per square metre. Note that this is for a horizontal surface; whereas solar panels are normally mounted at an angle and receive more energy per unit area. The small black dots show the area of solar panels needed to generate all of the world's energy using 8% efficient photovoltaic.

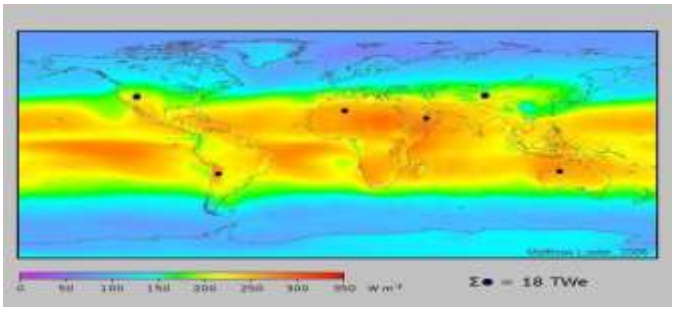


Figure: 1.3 Total Surface Area required to Fuel the World with Solar

### 1.4 Biomass Energy

Main features of biomass energy

The striking feature of biomass is that it is widely and freely available, simple to use and low cost. Biomass is used largely and inefficiently in the rural areas for cooking and heating purposes. About one billion people in the world use biomass for cooking. But biomass has significantly higher potential. Biomass can be converted into modern energy carriers such as gaseous and liquid fuels and electricity that can be widely used.

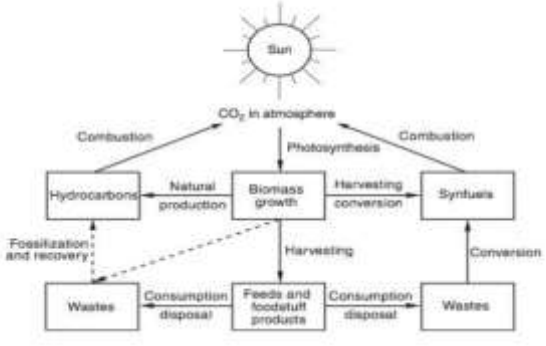


Figure: 1.10 Main Features of Biomass Energy

### 1.5 Multi-hybrid Renewable Energy System with combination of Solar PV, Wind and Biogas system.

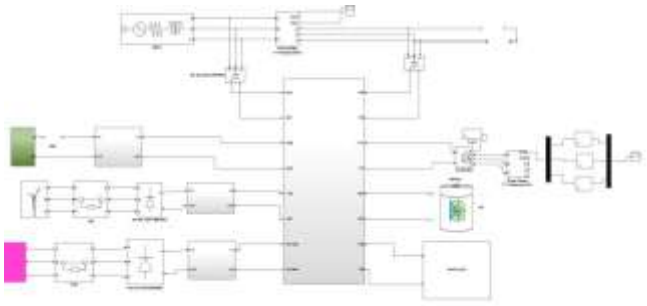

Figure: 1.4 Simulating Block diagram of Multi-hybrid Renewable Energy System with combination of Solar PV, Wind and Biogas system. Simulation diagram of Solar-Wind-Biomass without fault

### 1.6 Solar-Wind-Biogas all connected to line as fault is apply on the grid

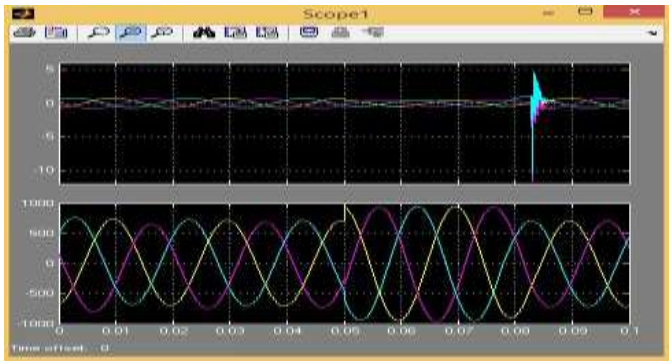


Figure:1.5 shows that a Solar-Wind-Biogas all connected to line as fault is apply on the grid 0.05 to 0.075 but grid not affect in line.

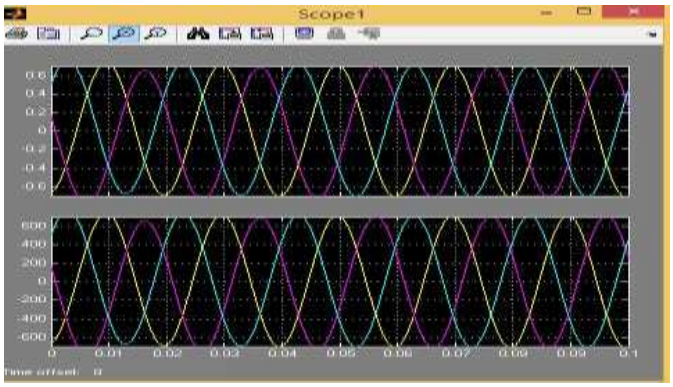


Figure: 1.6 Waveform of Solar-Wind-Biogas Voltage and Current across Grid without fault

### 1.7 Load Sharing

The current waveforms from the simulation results clearly indicate that the sources are supplying power proportional to their capacities. Thus, power supply to the load centre is asserted by the integrated system. The work in this paper is limited only to the integration of the sources, however,

simulation for some fault conditions and intermittency effect of renewable sources (*e.g.* wind and solar) on the output would be taken up in due course to have complete insight of the system.

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