

Implementation of Domestic Type Solar and Wind Hybrid System for Rural Electrification

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ABSTRACT

The power demand in our country is increased so that there is a consistent power cut in our region. This is because of high power consumption by factories and also due to less availability of non-renewable energy resources. So it is a known fact that the application of hybrid energy system based rural remote area electrification will offer a quick, economic and reliable answer to the rural household's need for power especially, for those of light duty appliances. This Solar-wind energy system can considerably result in reducing 20-50% of our power requirement in our home. A renewable hybrid energy system consists of two or more energy sources, a power conditioning equipment, a controller and an optional energy storage system. These hybrid energy systems are becoming popular in remote area power generation applications due to advancements in renewable energy technologies and substantial rise in prices of petroleum products. In this research will combine photovoltaic and wind to make hybrid system. The wind energy systems may not be technically viable at all sites because of low wind speeds and being more unpredictable than solar energy. The combined utilization of these renewable energy sources are therefore becoming increasingly attractive and are being widely used as alternative of oil-produced energy.

Keywords: Hybrid Energy System, Renewable Energy, Power, PV and Wind

I. INTRODUCTION

1.1 Resource of Energy

The standard of living of the people of any country is considered to be proportional to the energy consumption by the people of that country. In one sense, the disparity one feels from country to country arises from the extent of accessible energy for the citizens of each country. Unfortunately, the world energy demands are mainly met by the fossil fuels today. The geographical non equi-distribution of this source and also the ability to acquire and also control the production and supply of this energy source have given rise to many issues and also the disparity in the standard of living.

The world energy consumption pattern is also increasing as shown in the Fig.1. The energy consumption has been increasing and it will triple in a period of 50 years by

2025. Data on fossil fuel consumption by fuel type. The fossil fuel use as energy source has many limitations. There are a number of pollutants that have been identified as coming out of the use of fossil fuels and they are serious health hazards.

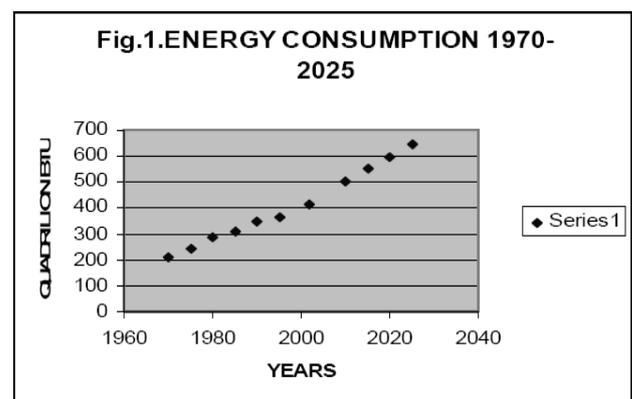


Figure 1. Energy consumption variation

1.2 Hybrid Energy System

Hybrid renewable energy systems (HRES) are becoming popular for remote area power generation applications 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 provide increased system efficiency as well as greater balance in energy supply.

Hybrid Wind-Solar System for the rural exchanges can make an ideal alternative in areas where wind velocity of 5-6 m/s is available. Solar-wind power generations are clear and non-polluting. Also they complement each other.

During the period of bright sunlight the solar energy is utilized for charging the batteries, creating enough energy reserve to be drawn during night, while the wind turbine produce most of the energy during monsoon when solar power generation is minimum.

Thus the hybrid combination uses the best of both means and can provide quality, stable power supply for sustainable development in rural areas.

These systems are specifically designed to draw 48 volts DC power output from the solar cells/ wind turbines and combine them to charge the storage batteries. The system does require availability of diesel generator, though for much reduced number of hour's operation.

II. METHODS AND MATERIAL

Block Diagram of Hybrid System

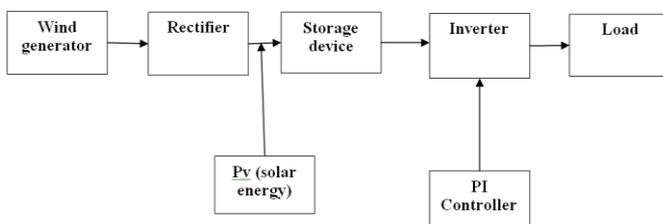


Figure 1. Block Diagram of Hybrid System

Working of Hybrid System

Hybrid systems are the ones that use more than one energy resources. Integration of systems (wind and solar)

has more influence in terms of electric power production. Such systems are called as “hybrid systems”.

Hybrid solar-wind applications are implemented in the field, where all-year energy is to be consumed without any chance for an interrupt. It is possible to have any combination of energy resources to supply the energy demand in the hybrid systems, such as solar and wind. This paper is similar with solar power panel and wind turbine power. Differently, it is only an add-on in the system. Photovoltaic solar panels and small wind turbines depend on climate and weather conditions. Therefore, neither solar nor wind power is sufficient alone. A number of renewable energy expert claims to have a satisfactory hybrid energy resource if both wind and solar power are integrated within a unique body.

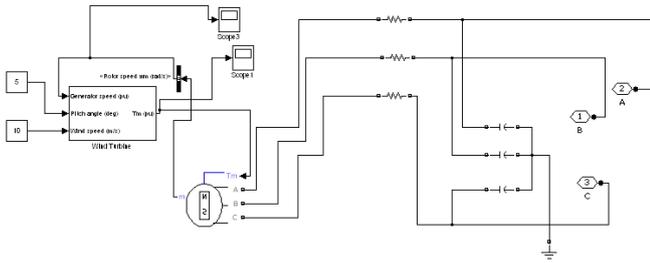
In the summer time, when sun beams are strong enough, wind velocity is relatively small. In the winter time, when sunny days are relatively shorter, wind velocity is high on the contrast. Efficiency of these renewable systems show also differences through the year. In other words, it is needed to support these two systems with each other to sustain the continuity of the energy production in the system.

In the realized system, a portion of the required energy for an ordinary home has been obtained from electricity that is obtained from the wind and solar power. Depending on the environmental conditions, required energy for the system can be supplied either separately from the wind or solar systems or using these two resources at the same time. Control unit decides which source to use for charging the battery with respect to condition of the incoming energy.

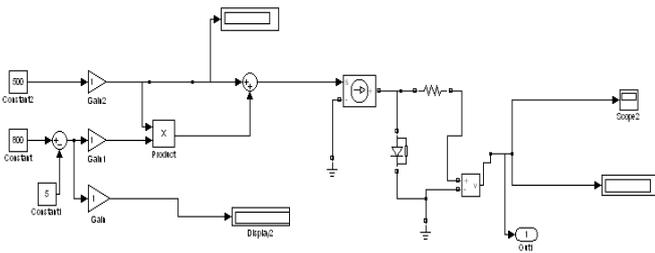
Wind turbine first converts the kinetic energy to mechanical energy and then converts it to the electricity. The wind turbine in the system consists of tower, alternator, speed converters (gear box), and propeller. The kinetic energy of the wind is converted to the mechanical energy in the rotor. . The hybrid system is designed based on the 78W load. We are approximating the 78W as 100W load, for which we had divided the 100W source as the combination of 50W solar and 50W wind as source to meet the load demand of 100W.

III. RESULT AND DISCUSSION

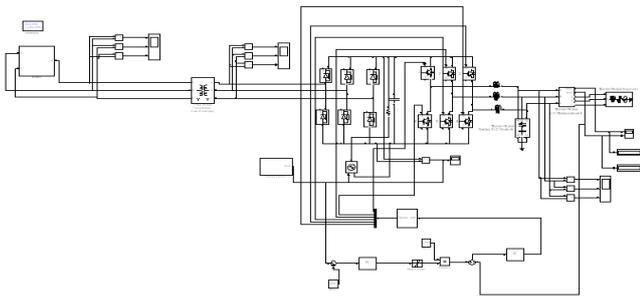
3.1 Wind Power System



3.2 PV Array

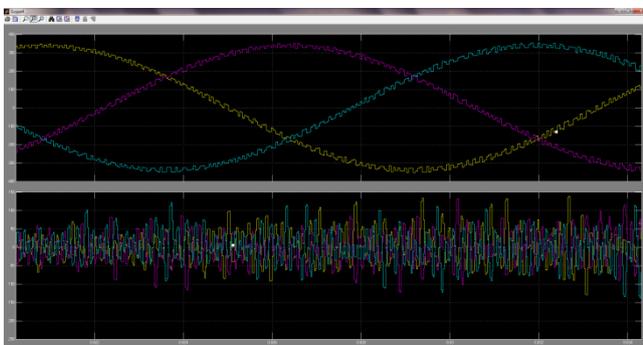


3.3 Hybrid of Solar and Wind

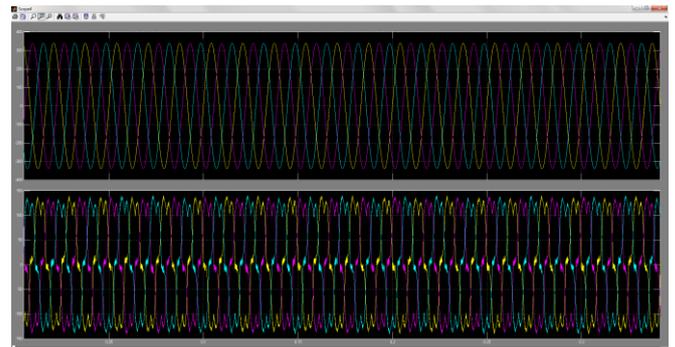


IV. SIMULATED OUTPUT

Without solar



With solar



V. CONCLUSION

In this study, "A Domestic Type Solar-Wind Hybrid System Design and Application" was implemented. A portion of the energy requirement for a home has been supplied with the electricity generated from the wind and solar power.

In the present scenario standalone solar photovoltaic and wind systems have been promoted around the globe on a comparatively larger scale. These independent systems cannot provide continuous source of energy, as they are seasonal. The solar and wind energies are complement in nature. By integrating and optimizing the solar photovoltaic and wind systems, the reliability of the systems can be improved and the unit cost of power can be minimized.

A PV wind hybrid systems is designed for rural electrification for the required load at specified Deficiency of Power Supply Probability (DPSP). A new methodology has been developed to determine the size of the PV wind hybrid system using site parameters, types of wind systems, types of solar photovoltaic system, number of days of autonomy of battery and life period of the system.

VI. REFERENCES

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