

Solar-Wind Hybrid Energy Generation System

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Abstract— As the race for global industrialization begin late in 18th century, the developing technology made humans to depend on energy, so as the energy crisis begins, in this modern era, electricity become a most essential need of human beings, from household to industrial work. So, the purpose of the project is to generate electricity without using non-renewable resources and pollution. Since, renewable standalone energy generation system have disadvantages, which need to be overcome by hybrid systems. Wind and solar energy have being popular ones owing to abundant, ease of availability and convertibility to the electric energy. This work covers realization of hybrid energy system for multiple applications, which runs under a designed circuitry to utilize the solar and wind power. And a designed circuitry for more efficient results, and inverters to convert the electrical energy as per demand.

Keywords—Hybride Energy; Solar System; Wind Energy; Renewable Energy; Clean Energy; Electrical Energy Generation

INTRODUCTION

Hybrid Renewable Energy Systems (HRES) 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, or hybrid power, usually consists of two or more renewable energy sources used together to provide increased system efficiency as well as greater balance in energy supply.

Most of us already know how a solar/wind power generating system works, all these generating systems have some or the other drawbacks (considering standalone system), like Solar panels are too costly and the production cost of power by using them is generally higher than the conventional process, it is not available in the night or cloudy days. Similarly Wind turbines can't operate in high or low wind speeds.

Solar hybrid power systems are hybrid power systems that combine solar power from a photovoltaic system with another power generating energy source. This would create more output from the wind turbine during the winter, whereas during the summer, the solar panels would produce their peak output. Hybrid energy systems often yield greater economic and environmental returns than wind, solar, geothermal or trigeneration stand-alone systems by themselves.

PROPOSED SYSTEM

Block/System Diagram

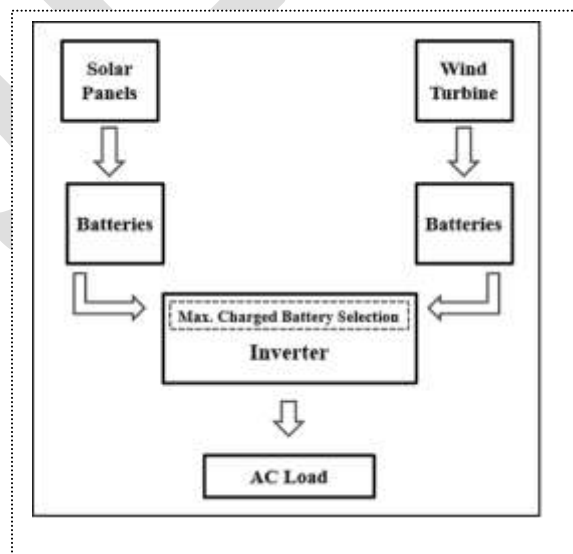


Fig.1. Block diagram of proposed system.

Block/System Description

The proposed system is the hybrid/combination of two individual system as, solar system and wind system. The block wise description is as follows,

Solar Panel:

Solar panel / PV panel are used to convert the renewable power coming from the sun into electrical energy. The principle of working solar panel is with semiconductors. Since, the whole eco-system on planet earth is dependent on sun energy and it's a huge source of never ending energy. Due to ace of availability, easily interpretation, amount of source and popularity it is preferred for project.

Solar panels are photovoltaic which, generates electrical energy using sun light radiations. Depending on the position and intensity of the sun radiation the amount of electrical DC energy will produced. For the proposed project specifications and design, a 12V, 150 watt off grid solar panel is required. The standard size of the panel, available in the market, 48inch x 22inch x 2inches is most suitable however, other sizes can be considered.

Wind Turbine:

The wind is available 24 hours in earth's eco system. Wind turbine having large blades which are joined to rotor of generator leading to produce electrical energy as moves by flow of wind. Wind power is also renewable, never energy source and easily available within atmosphere. Wind turbine power plants are much more popular providing much more efficiency considering the space of implementation.

Wind Turbine is mechanical system/machine which generates electrical energy from renewable wind energy source. Depending on the speed of the wind the amount of electrical AC energy will produced. For the project, a 500 watt, having 3 blades of 1 meter radius, wind turbine generator will be needed. The height of the wind turbine should be 18 meters. For foundation of it a 2 x 2 x 4 m space required.

Batteries:

The electrical energy produced by the system is need to be either utilized completely or stored. Complete utilization of all the energy produced by the system for all the time is not possible. So, it should be store rather than useless wasting it. Electrical batteries is the most relevant, low cost, maximum efficient storage of electrical energy in the form of chemical reaction. Hence, batteries are preferred.

The energy generated from the proposed project is need to be store. So, two batteries is needed. One is attached to wind turbine for which a 120AmpH battery will be required, which will be fair enough full fill the storage capacity for targeted value. The second battery is 80AmpH is preferred for storing solar energy. But, as per application/ storage and demand battery capacity can be variable.

Inverter:

Inverter is a electronic system, converters direct current into alternating current, i.e. DC into AC. The stored electrical energy in the batteries is DC in nature. And it cannot utilized for various kinds of load. So, for delivering AC supply to the load inverter system is required. Inverter is either analog or digital kind. Digital inverter is microcontroller based which increase the buildup cost of the system also, is uses MOSFET technology providing more efficiency. But, considering the financial aspect and resolution the proposed project designs and build the inverter analog in nature.

The input energy is in DC (12V) form stored in the batteries. It will convert it into AC with ~230V, 500W (the maximum value of load to be attach), ~50Hz specification matching with the house hold mains supply. At output, AC loads can be attach.

Maximum Charged Battery Selection:

Maximum charged battery selection, a specially designed circuit used to detect the maximum amount of stored electrical energy in each batteries. It is attached within the inverter circuit. So, the inverter box/block will enclosed this. The circuit is made up of transistor family device like BJT's, MOSFET's along with diodes, resistors and capacitors.

LITERATURE SURVEY AND METHODOLOGY USED

Name of IEEE/Journal Paper	Method/Algorithm Used	Results
Hybrid system of PV solar/wind & fuel cel [3]	Use of wind power, solar cell, fuel cell	Concept is two or more renewable power source connected to grid
Control of Hybrid Solar-Wind system with acid battery [5]	Use of Solar power, Wind power, Acid battery, Micro-Controller	Electric lead acid batteries are device provide electrical energy from Chemical
Design & Implementation of Domestic Solar-wind Hybrid Energy System [6]	Use of Solar Energy, Wind Energy, Solar battery and MPPT.	Portion of energy requirement for home has been supplied.

Fig.2. Comparative study of surveyed paper.

Referring, Ugur FESLI, Raif BAYIR, Mahmut OZER has proposed project on, "Design & Implementation of Domestic Solar-Wind Hybrid Energy System".

It state that, the demand for more energy is full filled by using renewable source like wind power, solar power. This can be archived by using hybrid energy system connected to grid i.e. wind power energy generation and solar energy generation produces energy without fluctuations.

The system proposed uses a designed circuit consist of transistor and relay. This circuits added in the inverter, while input is taken from batteries. As, any one battery get fully charged, the circuit gets activated, due to fully charge battery triggers the transistor. The activated circuit is make the poles of relay for contact and the charge battery gets selected to provide the DC supply to inverter.

EXISTING SYSTEM

Completely Renewable Hybrid Power Plant (solar, wind, biomass, hydrogen) a hybrid power plant consisting of these four renewable energy sources can be made into operation by proper utilization of these resources in a completely controlled manner. Hybrid Energy Europe - USA. Caffese in Europe introduce hybridizing HVDC transmission with Marine hydro pumped Energy Storage via elpipes.The project of Caffese is 3 marine big lakes producing 1800 GW and transmission with elpipes. A part 1200 GW produce waterfuels-windfuels-solar fuels 210 billion liter year. (IEEE Power and Engineering Society-General Meeting Feb.9.2011,Arpa-E, Doe USA, MSE Italy, European Commission-Energy-Caffese plan and Consortium)

The Hassi R'Mel power station in Algeria, is an example of combining concentrating solar power (CSP) with a gas turbine, where a 25-megawatt (MW) CSP parabolic trough array supplements a much larger 130 MW combined cycle gas turbine plant. Another such integrated solar combined cycle power station is the Yazd power station in Iran (*also see ISCC*).

ADVANTAGES

The advantages covered by the propose system are listed as,

- Overcoming disadvantages of standalone renewable electrical energy generation system.
- Producing much more efficiency as two or more renewable energy generation system working together in the terms of electrical energy generation.
- Since, the system doesn't have microcontroller or microprocessor the complexity of system testing and understanding became easy in terms of difficulties.
- System maintains is remarkably reduced and becomes easy.
- Renewable energy sources like, sun, wind,. Are utilized so, no waste production.
- Producing clean, friendly to environment, renewable energy.
- Once the system is designed and developed or manufactured, the installation of system is easy.
- Within certain time period the installation cost gets covered.
- If the system gets damaged in case, no need of changing entire system or subsystem. Just, changing a damage component will work out.

DISADVANTAGES

There's no system without having a disadvantage. So as, the system have disadvantages as follow:

- The first time installation cost is huge in terms of finance.
- The circuit designing complexity is more as there in no micro-computer for controlling action.

APPLICAATION

Some of the applications for the purpose system are listed follow,

- The system is used for domestic purpose.
- Street lighting, Traffic signals.
- Various monitoring systems.
- Powering up for communication system.
- Pump irrigation Systems.
- Small Boats like yatch.
- As per requirement of electrical energy the system can be either designed or updated for higher energy requirement.
- When ac mains supply is not available, the proposed system can be used as emergency system with only few changes.
- So, it can be used for almost every electronic, mechanic, viz. system needing/ require electric energy to work on.

FUTURE SCOPE

As the awareness of non-renewable sources and pollution causes by them, the clean energy production with renewable sources is widely preferred and day by day implementation of such sources going on, so, research and resources are also increasing for such plants and projects.

As the first time installation cost is higher due to design and manufacturing perspective. The system can be monitories using graphical user interference on computer. So, the whole information will be available to user and/or stored regarding further applications and development.

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