

HYBRID INTEGRATED SOLAR AND WIND POWER GENERATION SYSTEM FOR REMOTE AREAS

¹S.Chandraleka, ²S.Rathinavel.,M.E.

¹M.E (PED), ²Assistant Professor
Paavai Engineering College,
Nammakkal, Tamilnadu-6370018, India.

Abstract: Now a day's electricity is most essential facility for the human being. One of the primary needs for socio-economic improvement in any nation in the world is the provision of reliable electricity supply systems. This work is a improvement of an indigenous technology hybrid Solar Wind Power system that harnesses the renewable energies in Sun and Wind to generate electricity. Here, electric DC energies produced from photovoltaic and wind turbine systems are transported to a DC disconnect energy Mix controller. The controller is bidirectional connected to a DC-AC float charging-inverter system that provides charging current to a heavy duty storage bank of Battery and at the same time produces inverted AC power to AC loads. All the conventional energy resources are depleting day by day. So we have to shift from conventional to non-conventional energy resources. In this the combination of two energy resources is takes place i.e. wind and solar energy. This process reviles the sustainable energy resources without damaging the nature. Solar panels are used for converting solar energy and wind turbines are used for converting wind energy into electricity. This electrical power can utilize for various purpose. Generation of electricity will be takes place at affordable cost. This paper deals with the generation of electricity by using two sources combine which leads to generate electricity with affordable cost without damaging the nature balance and essential for information communication technology infrastructure and people in rural communities.

Keywords: Electricity, Hybrid, solar, power, wind, Socio Economic development, Hybrid system, Solar and Wind Power, remote areas

I INTRODUCTION

One of the primary needs for socio-economic improvement in any nation in the world is the condition of reliable electricity supply systems. Electricity is most needed for our day to day life. There are two ways of electricity generation either by conventional energy resources or by non-conventional energy resources. Electrical energy demand increases in word so to fulfill demand we have to generate electrical energy. Now a day's electrical energy is generated by the conventional energy resources like coal, diesel, and nuclear etc. The main drawback of these sources is that it produces waste like ash in coal power plant, nuclear waste in nuclear power plant and taking care of this wastage is very costly. And it also damages he nature. The nuclear waste is very harmful to human being also. The conventional energy resources are depleting day by day. Soon it will be completely vanishes from the earth so we have to find another way to generate electricity.

The new source should be reliable, effluence free and economical. The non-conventional energy resources should be good alternative energy resources for the conventional energy resources. There are many non-conventional energy resources like geothermal, tidal, wind solar etc. While geothermal energy needs very lager step to extract heat from earth. Solar and wind are easily available in all condition. The non-conventional energy resources like solar, wind can be good alternative source. Solar energy has drawback that it could not produce electrical energy in rainy and cloudy season so we need to overcome this drawback we can use two energy resources so that any one of source fails other source will keep generating the electricity. And in good weather condition we can use both sources combine.

II IMPORTANCE OF HYBRID ENERGY SYSTEM

The global search and the rise in the cost of conventional remnant fuel is making supply-demand of electricity product almost impossible particularly in some remote areas. Generators which are often used as an alternative to conventional power supply systems are known to be run only during certain hours of the day, and the cost of fuelling them is increasingly becoming not easy if they are to be used for commercial purposes. There is a growing awareness that renewable energy such as photovoltaic system and Wind power have an important role to play in order to save the situation. Hybrid energy system is the combination of two energy sources for giving power to the load. In other word it can defined as "Energy system which is made-up or designed to extract power by using two energy sources is called as the hybrid energy system." Hybrid energy system has good reliability, efficiency, less emission, and lower cost. In this proposed system solar and wind power is used for generating power. Solar and wind has good advantages than other than any other non-conventional energy sources. Both the energy sources have greater ease of use in all areas. It needs lower cost. There is no need to find special location to install this system.

III SOLAR ENERGY

Solar energy is that energy which is gets by the radiation of the sun. Solar energy is present on the earth continuously and in plentiful manner. Solar energy is freely available. It doesn't produce any gases that mean it is pollution free. It is affordable in cost. It has low maintenance cost. Only problem with solar system it cannot produce energy in bad weather condition. But it has greater efficiency than other energy sources. It only need initial investment. It has long life span and has lower emission. There are two types of solar systems; those that convert solar energy to D.C power, and those that convert solar energy to heat. Back-Emf of each phase has a phase difference of 120 electrical degrees and back- Emf and rotor condition are related

IV WINDENERGY

Wind energy is the energy which is extracted from wind. For extraction we use wind mill. It is renewable energy sources. The wind energy needs less cost for generation of electricity. Maintenance cost is also less for wind energy system. Wind energy is present almost 24 hours of the day. It has less emission. Initial cost is also less of the system. Generation of electricity from wind is depend upon the speed of wind flowing. The major disadvantages of using independent renewable energy resources are that unavailability of power for all time. For overcoming this we use solar and wind energy together. Wind Power is energy extracted from the wind, passing through a machine known as the windmill. Electrical energy can be generated from the wind energy. This turbine transforms the wind energy to mechanical energy, which in a generator is converted to electrical power. An integration of wind generator, wind turbine, aero generators is known as a wind energy conversion system.

V BLOCK DIAGRAM OF HYBRID ENERGY GENERATION SYSTEM

SOLAR PANEL

Solar panel is use to convert solar rays to the electrical energy. The physical of PV cell is very similar to that of the classical diode with a PN junction formed by semiconductor material. When the junction absorbs light, the energy of captivated photon is transferred to the electron- proton system of the material, creating charge carriers that are separated at the junction. The charge carriers in the junction region create a potential gradient, get accelerated under the electric field, and circulate as current through an external circuit. Solar array or panel is a group of a several modules electrically connected in series parallel combination to generate the required current and voltage. Solar panels are the medium to convert solar power into the electrical power.

5.1 Battery Bank

We have to choose battery bank size per the load requirement so that it should fulfil the requirement of load for calculating the battery bank size we need to find following data Find total daily use in watt-hour (Wh). Find total back up time of the battery For increase in battery bank size we need to connect cell in series so that we can get the larger battery bank size.

5.2 Charge Controller

Charge controller has basic function is that it control the source which is to be active or inactive. It simultaneously charge battery and also gives power to the load. The controller has over-charge protection, short-circuit protection, pole confusion protection and automatic dump- load function.

It also the function is that it should vary the power as per the load demand. It add the both the power so that the load demand can fulfill. And when power is not generating it should extract power from battery and give it to the load.

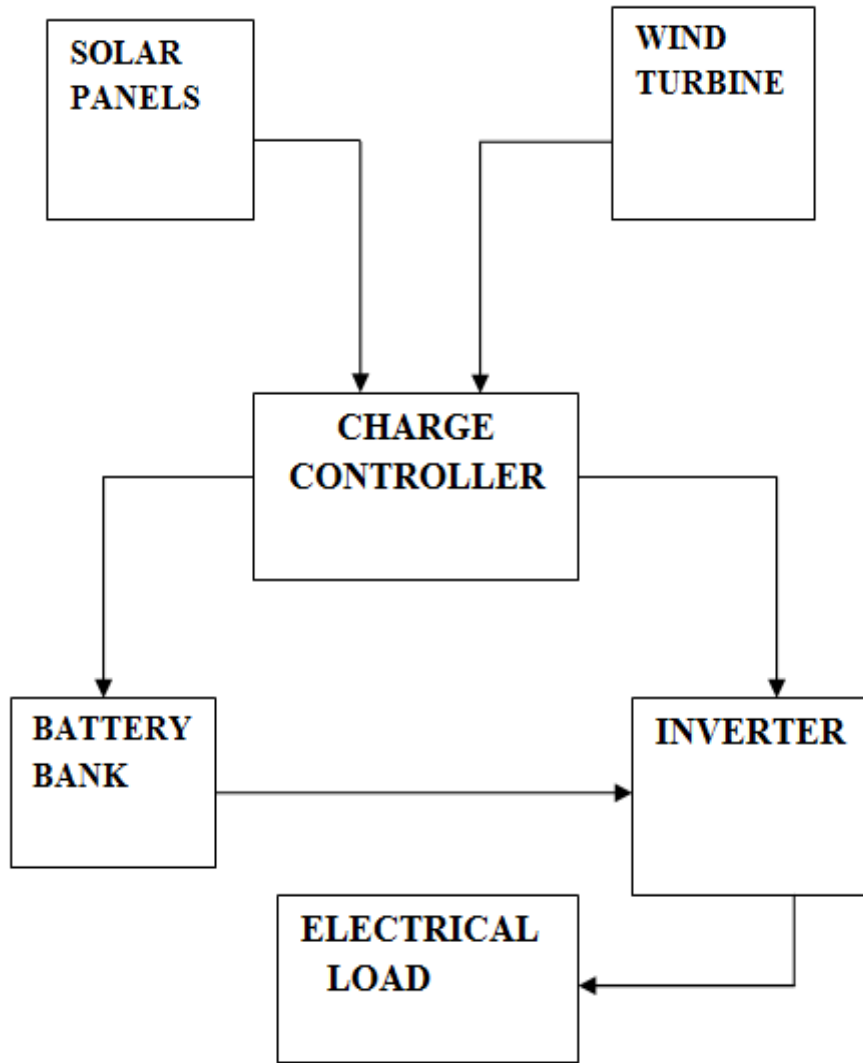


Figure 1. Block Diagram of Hybrid Energy Generation System Solar Panel

5.3 Wind Turbine

A wind turbine is a machine for converting the kinetic energy in wind into mechanical energy. Wind turbines can be separated into two basic types based on the axis about which the turbine rotates. Turbines that rotate around a horizontal axis are more common. Vertical-axis turbines are less frequently used.

5.4 Inverter

We have to choose greater rating inverter than the desired rating. The pure sine wave inverter is suggested in order to prolong the life span of the inverter.

Inverter is needed to convert DC power into AC power. As our load works on the AC supply so we need to convert DC power. The input voltage, output voltage and frequency, and overall power handling depends on the design of the specific device or the circuitry. The inverter does not produce any power. The power is provided by the DC source.

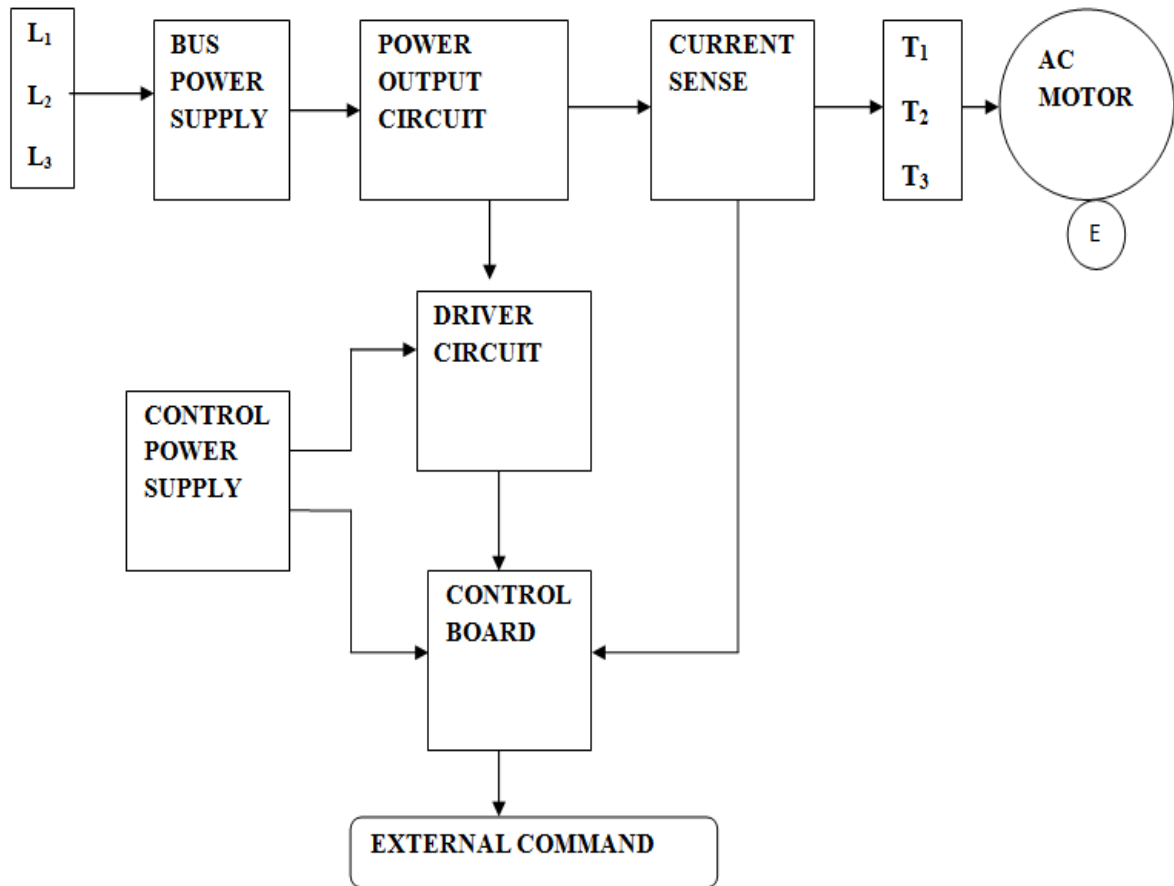


Figure 2. Hybrid Energy Generation Inverter

5.5 Rural Development Information Communication Technology

In the recent times, ICT has been acknowledged as a means of fighting poverty and illiteracy in developing economics like Nigeria, if we are to meet Millennium improvement targets. The ICT is one major key tool to facilitate e-service programmes, especially to those institutions such as banks, hospitals and schools in rural and unreached communities. When this is achieved, the socio-economic lives of rural citizens will be improved. To provide ICT for Rural livelihoods, there is always the need to ascertain an enabling environment.

Table.1 Energy Needed For A Typical ICT Center In Rural/Remote Environments

Description of Item	Qty	Load(Watts per unit)	Load(Watts) Total	Weekly Hour of Actual Utilization (hours)	Weekly Watts Hours
Router	1	25	25	48	1,200
Port fast Switch	1	15	15	48	720
Wireless Access Point	2	12	24	48	1,152
Server(plus accessories)	1	150	150	48	7,200
RF(Radio Communication)	1	40	150	48	1,920
Laptops (with security cables)	10	40	400	48	18,200
VOIP Phones	2	20	40	16	640
HP desk jet 5943	2	44	88	8	704
Laser Printer	1	100	100	7	700
Lighting	4	15	60	48	2,880
Ceiling fans	4	60	240	48	11,520
TOTAL					46,836Wh

Table. 2 Solar Energy needed for a typical Hospital Solar Energy needed for a typical Hospital Service in Rural/Remote environment

Description of Item	Qty	Load (Watts per unit)	Load (Watts) Total	Weekly Hour of Actual Utilization (hours)	Weekly Watts Hours
Cold Chain Storage (fridge)	1	60W	60W	48	2,400
Lighting for the operating Theatre	3	15W	45W	48	2160
Lighting for Ward	6	15W	90W	48	4320
Premises Lighting/Street Light	2	40W	80W	12	1. 960
Television Colour	1	150W	150W	6	2. 900
Fans	6	15W	40W	48	1920

Among the basic needs to actualize vision 2020 and MDGs are the provision of hospital and Banking facilities to rural environments. As said earlier, one of the major needs to actualize functional and reliable rural banking and hospital is the availability of a continuous and reliable power supply system. Hence, the use of uninterrupted power source, solar energy would be advantageous to facilitate good rural banking, hospitals and ICT.

VI CONCLUSIONS

Hybrid power generation system is good and effective solution for power generation than conventional energy resources. It has greater efficiency. It can provide to remote places where government is unable to reach. So that the power can be utilize where it generated so that it will reduce the transmission losses and cost. Cost reduction can be done by increasing the production of the equipment. People should motivate to use the non-conventional energy resources. It is highly safe for the environment as it doesn't produce any emission and harmful waste product like conventional energy resources. It is cost effective solution for generation. It only need initial investment. It has also long life span. There is the need for the provision of an alternative sustainable electric power supply system to provide electricity to rural and the unreached communities. Also there is the need for rural banking and hospitals if the social and economic lives of rural citizens in Nigeria are to be improved. When considering the cost and overall efficiency, it is advisable for all the stakeholders who have concern for the rural community development to embrace solar and wind power.

REFERENCES

- [1] I. A. Adejumobi, S.G. Oyagbinrin, F. G. Akinboro & M.B. Olajide, "Hybrid Solar and Wind Power: An Essential for Information Communication Technology Infrastructure and people in rural communities", IJRRAS, Volume 9, Issue 1, October 2011, pp 130-138.
- [2] Kavita Sharma, Prateek Haksar "Designing of Hybrid Power Generation System using Wind Energy- Photovoltaic Solar Energy- Solar Energy with Nanoantenna" International Journal of Engineering Research And Applications (IJERA) Vol. 2, Issue 1, Jan-Feb 2012, pp.812-815
- [3] Sandeep Kumar, Vijay Kumar Garg, "A Hybrid model of Solar-Wind Power Generation System", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering (IJAREEIE), Vol. 2, Issue 8, August 2013, pp. 4107-4016.
- [4] E.E. Iheonu, F.O. A. Akingbade, M. Ocholi Wind Resources Variations over selected sites in the West African sub-region. Nigerian J. Renewable Energy, 10, 43-47(2014).
- [5] W.W.S. Charters. "Solar and Wind Power Technologies for Remote Applications". CSC Technical Publication Services No187, Commonwealth Science Council. (2011).
- [6] S.I. Iwuoha, Wind Powered Horizontal Maize Grinder, NJRE, 11, 46-57(2013).
- [7] B.K. Gupta ,Wiebull Parameters for Annual and Monthly Wind Speed Distributions for Five Locations in India, Solar Energy. 37, 469-477.(2012)
- [8] C.G. Justus, W.R. Hargraves, and A. Yalcin, Nationwide assessment of potential output from wind power generators, J. Appl. Meteor. 15, 673-678. (2013)

- [9] S.O. Enibe, A Method of Assessing the Wind Energy Potential in a Nigerian Location. Nigerian Journal of Solar Energy. 6, 14-20. (2016).
- [10] V. Quaschnig. "Understanding Renewable Energy Systems". Earthscan, London. (2015).

