Gundip Singh al. International Journal of Research Aspects of Engineering and Management, ISSN: 2348-6627, Vol. 3, Issue 1, Feb 2015, pp. 1-4

Hybrid Power Generation Using Renewable Energy Sources For Domestic Purposes

Gundip Singh

Department of Electrical Engineering, Manav Bharti University, Solan, H.P. India

Abstract: **This paper will describe a hybrid system for generating dispatch able electric power using wind, solar and hydro energy combined together for domestic purposes and storage. The essential subsystems include vertical axis wind turbines solar panel and a pico-hydro system. This hybrid power generation system will be particularly useful in charging batteries, lighting up of CFL, playing of radio. This hybrid wind / solar/hydro system would be a more economical means for achieving zero-emission, firm, dispatch able capacity than independent construction of wind and solar plant or a pico- hydro plant generating system.**

Keywords: **Dispatch Able, Hybrid, Zero Emission.**

I. INTRODUCTION

A hybrid electric power generation system consists of two or more types of renewable resources. While fossil fuel will be the main fuels for thermal power, there is a fear that they will get exhausted eventually in the next century. Therefore other systems based on non-conventional and renewable sources are being explored and developed by many countries including our India.

Renewable energy sources have attracted special attention due to the security of energy supply by reducing the dependence on imported fossil fuels. And also there is a reduction in emission of green house gases like co2 from the burning of fossil fuels. Hence renewable energy sources are sustainable energy sources that can be relied upon for a long time span.

II. SURVEY

At the current energy consumption rate, proven coal resources should last for about 200 years, oil for 40years and natural gasses for 60years. As predicted there will be a 40+ percent increase in the world's renewable-generated electricity over next 5years.Wind energy is the world's fastest growing energy source, expanding globally at a rate of 25% to 35% annually over the last decade. Hydro is the second largest available renewable resource and its energy market is around 20% to 30% annually. Solar technologies are predicted to be 4.9% of global renewable electricity by 2017.

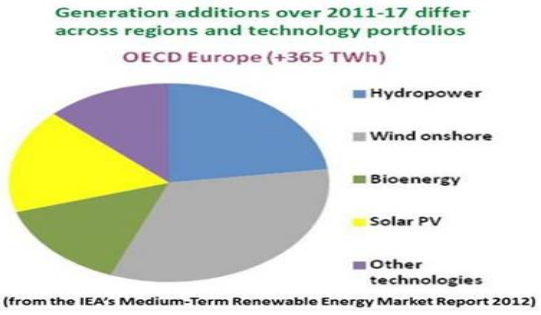

Fig. 1: Global report on renewable energy sources.

III. METHODOLOGY

If all the three sources are combined into one hybrid power generating system the drawbacks can be avoided partially or completely, depending on the control units. As it is generally seen those in rainy and windy days the solar power is limited and vice versa and hence to overcome this hybrid power generation is very useful. By this the power generation can be maintained in the above stated condition. The control of hydro, solar, and wind power plants is provided through a constant current controller.

A system is proposed in which hybrid power generation system is connected with the utility grid. The parallel combination of these three energy systems has been adopted and for the continuous power flow grid is also connected. In summer, the grid connected solar system supplies the power to the load, hydro and wind system will be disconnected and same applies for the rainy and windy conditions. Hence it is good a option to adopt the proposed system for supplying continuous power to the consumer.

IV. WORKING

Solar power generation: In actual usage, the solar cells are interconnected in certain series or parallel combinations to form modules. These modules are hermetically sealed for protection against corrosion, moisture, pollution and weathering. A combination of suitable module constitutes an array. One Square meter of fixed array kept facing south yields nearly 0.5kWhr of electrical energy on normal sunny day if the orientation of the array is adjusted to face the sun's ray at any time the output can be increased by 30%.

To obtain useful power output from photon interaction in a semi-conductor three processes are required. The photons have to be absorbed in the active part of the material and result in electrons being excited to a higher energy potential. The electron hole charge carrier created by the absorption must be physically separated and moved to the edge of the cell. The charge carriers must be

removed from the cell and delivered to the useful load before they lose their extra potential.

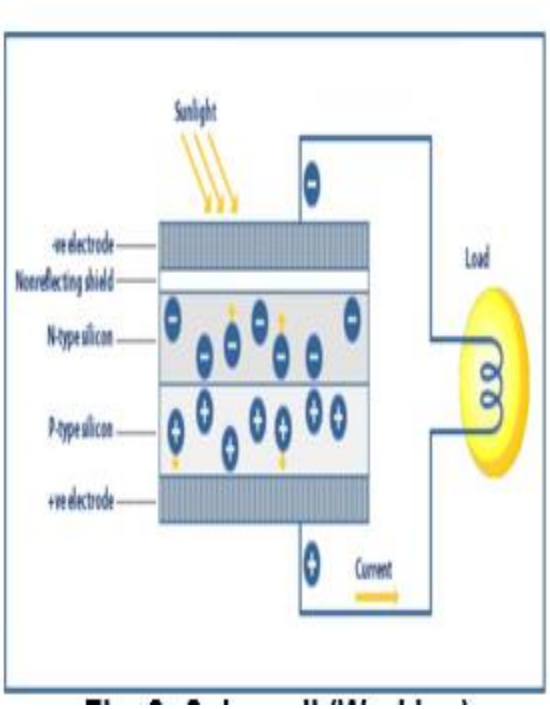

Fig. 2: Solar cell (Working)

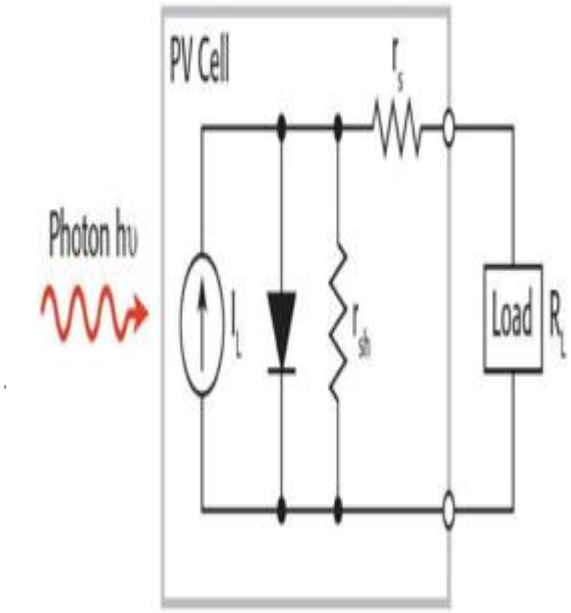

Fig. 3: Equivalent circuit of a solar cell

Hydro power generation: When w ater is pumped into the overhead tank using a motor, the water falling into the tank has certain amount of kinetic energy which can be utilized to generate electricity.

At the point where the water falls into the tank, a generator is connected which is coupled to a blade. And when the water falls on the blade, it starts rotating which induces emf in side the armature of the generator.

Fig. 4: Pico-hydro system

Wind power generation: Wind po wer is the conversion of wind energy into usefu l form of energy, such as using wind turbines to prod uce electricity. A wind turbine is a device tha t converts kinetic energy from the wind into electrical power. A wind turbine used for charging batteries may be referred to as a wind charger.

The WECS consists of various co mponents like aero-turbine, gearing, couplin g, controller and generator. Aero-turbine converts energy in moving air to rotary mechanical energ y. In general they require pitch and yaw control for pro per operatio

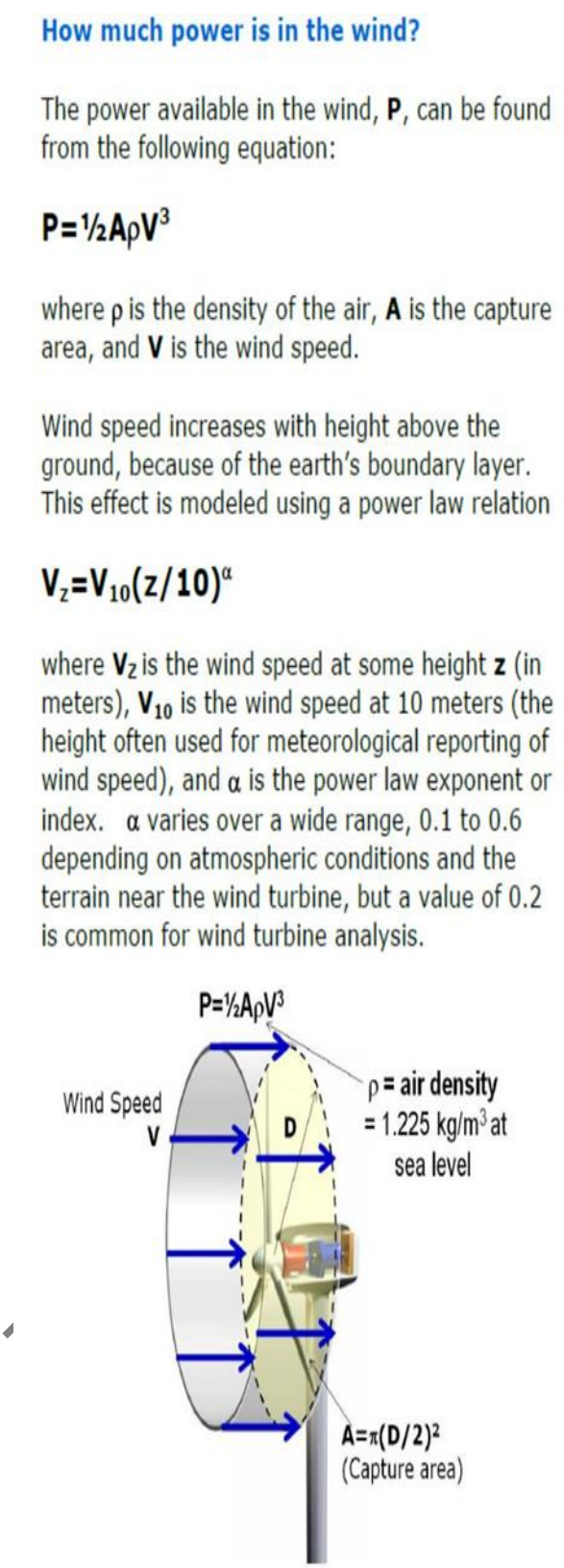

Fig. 5: conce pt of energy production in wind turbines

A mechanical interface con sisting of a step up gear and a suitable coupling transmits the rotary mechanical energy to an electrical generator. The output of the generator is connected to the battery.

The purpose of the controlle r is to sense the speed and direction of the wind , shaft speed and torques at one or more points and ou tput power by passing the control signal for ma tching the output and to protect the system from extreme conditions. The cut-in and cut-out speeds of the wind turbine are 5m/s and 25m/s respectively.

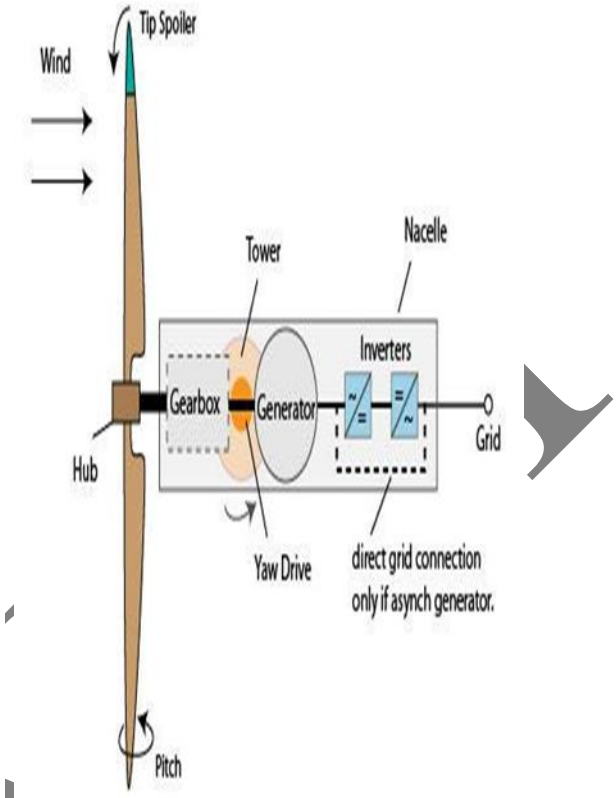

Fig. 6: Components of WECS

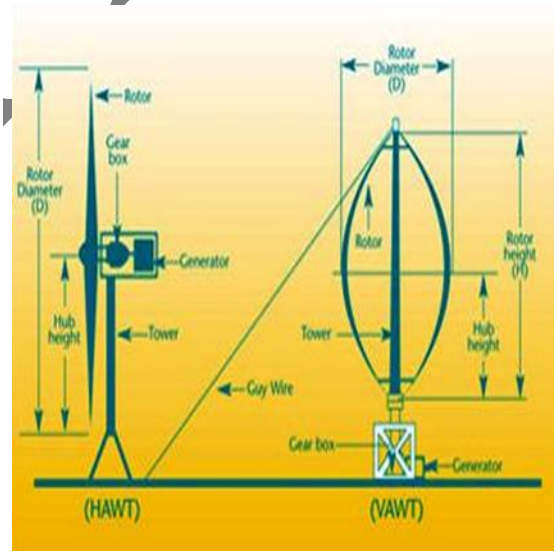

Fig. 7: Co mparison between HAWT and VAWT 5. HYBRID POWER GENERATION

We integrate all the three electric power generating modules to optimize the utilization of renewable energies. Since the outp ut from all the generating modules is variable, we make use of DC – DC converter (Buck converter) to get a fixed magnitude of DC.

A battery is made use of to s tore the electric power generated. We also mak e use of a charge controller which facilitates proper an d safe charging of the batteries.

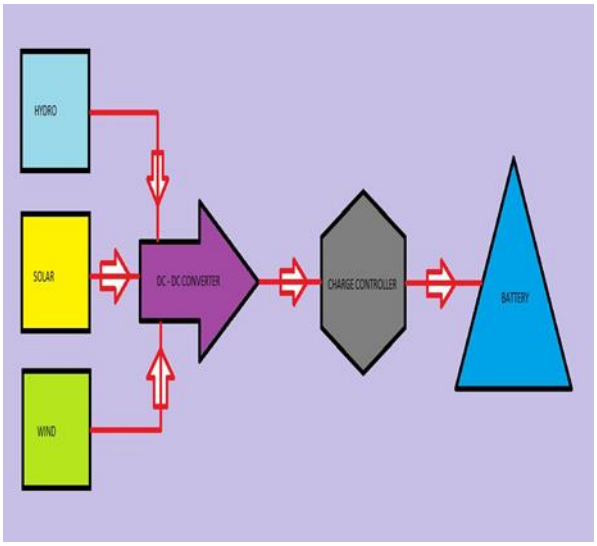

Fig. 8: Integration of all there generating sources

V. ADVANTAGES

Hybrid electric power generating systems usually supply island networks that are not connected to an integrated grid covering s everal houses.
Large potential for rural electrification especially with renewable energy sour ces can be found in developing countries.
It also provides continuous po wer supply to the consumers.
Hybrid power generation is no t seasonal.
Used to provide quality power to the consumers without any fluctuations.
Less maintenance and less ma power is required for its operation and control.

VI. DISADVANTAGES

Initial cost is high.
Monitoring of turbine speed in WECS is difficult.
Voltage generated is not const ant and hence voltage regulators must be made u se Since output is dc in all the three generating modules, inverters should be used

VII. APPLICATIONS

Since the project is being con entrated on fulfilling the domestic electric nee ds (for individual houses), home appliances such as CFLs, fans, radios can be supplied with the required electric power.
Once the domestic electricity needs are fulfilled, the excess electric power generated can be integrated to a nearby grid. (Micro scale power selling)
They usually supply island networks that are not connected to an integrated grid covering several regions.
Used to provide quality power to the consumers without any fluctuations.

REFERENCES

[1]. D. Das, R. Esmaili, L. Xu, D. Nichols, "An Optimal Design of a Grid Connected Hybrid Wind/Photovoltaic/Fuel Cell system for distributed Energy Production", Proc. IEEE Industrial Electronics Conference, pp. 2499-2504, Nov 2005.
[2]. N. A. Ahmed, M. Miyatake, A. K. Al-Othman, "Power fluctuations suppression of stand-alone hybrid generation combining solar photovoltaic/wind turbine and fuel cell systems", Proc. Of Energy Conversion and Management, vol. 49, pp. 2711-2719, October 2008.
[3]. Y.M. Chen, Y.C. Liu, S.C. Hung, C.S. Cheng, "Multi-Input Inverter for Grid-Connected Hybrid PV/Wind Power System", IEEE Transactions on Power Electronics, vol. 22, May 2007.
[4]. Teena Jacob, S Arun, "Model of hybrid wind and photovoltaic energy system using a new converter topology", (EEEIJ), vol. 1, no. 2, August 2012.
[5]. Sam G. Parler, Cornell Dubilier, Selecting and Applying Aluminium Electrolytic Capacitors for Inverter Applications.
[6]. Ray Ridley, "analysing the sepic converter", Power System Design Europe, November 2006.
[7]. Dongbing Zhang, "AN-1484 Designing A SEPIC Converter", Texas Instrument application report SNVA168E, May 2006.

