



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY

A futuristic digital interface with a glowing globe in the center. The interface includes various data visualizations like bar charts, line graphs, and pie charts. Text elements like 'BUSINESS', 'NETWORK SEARCH', 'LOADING 100%', and 'MEDIA' are visible. The background is dark blue with light blue highlights.

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 5, May 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118

9940 572 462

6381 907 438

ijrset@gmail.com

www.ijrset.com



Survey on Hybrid Wind-Solar Energy System using MPPT Algorithm for Grid Connected Application

Amrendra Pratap Singh¹, Prof. Balram Yadav²

M. Tech. Scholar, Department of Electrical and Electronics Engineering, Scope College of Engineering, Bhopal, India¹

Head of Dept., Department of Electrical and Electronics Engineering, Scope College of Engineering, Bhopal, India²

ABSTRACT: An Optimized power generation utilizes two or more production methods, usually solar and wind power. Wind solar hybrid controller is the core part of a wind-solar hybrid system A Charge Controller is a device that controls the flow of current to and from the battery subsystem to protect the batteries from overcharge and over discharge. There are different types of charge controllers such as Analog series/shunt mode charge controller, ON/ OFF charge controller. The characteristics of power produced from photovoltaic (PV) and Wind systems are based on the weather condition. Both the system are very unreliable in itself without sufficient capacity storage devices like batteries or back-up system like conventional engine generators. The reliability of the system significantly increases when two systems are hybridized with the provision of storage device.

KEYWORDS: Solar, Wind, Hybrid System, ON/OFF Controller

I. INTRODUCTION

In this modern world a wide range of problems are being faced, there are many green houses are being emitted which made a negative impact to our environment. The non-renewable energy sourced power stations are one of the contributors for emitting greenhouse gases [1]. Besides them these power stations are also main causes for many diseases occurring to people who are residing the power stations. Moreover these power stations are not permanent as the energy sources will be depleted soon. Large wind turbines use mechanical systems, such as geared or gearless devices to increase the speed of the generator. In addition, an inverter is employed to adjust the output voltage to exceed the grid value. With its phase leading the bus phase, wind power can be integrated into the grid bus [2].

The integration can be easily realized owing to negligible impedance of the utility bus. The main issues for wind power generating systems include fluctuations in output voltage and quality of power supplied to the utility power system. In renewable energy systems, wind power and solar energy are integrated to improve the reliability of the individual power system. Conventionally, the AC output voltage of the wind turbine is rectified, and then combined with the output voltage of the solar cell to charge the battery and provide power supply to the load [3].

Since the invention of first engine in 17th century, energy consumption has been highlighted due to different causes, such as political, economic, world population based, requirements of new technologies in use. Persistent increase in the energy demand has caused to seek new energy resources in the world. New alternative energy resources have been also utilized minimize the energy deficit World Energy Production/Consumption profile. Energy resources are classified into two groups primary-undeniable and secondary-renewable resources, with respect to change in quantitative [4, 5].

Unrenewable Energy Resources:- Unrenewable energy resources are the ones that decay partially or vanish with the time or needs decades for reuse, such as oil, coal and coal derivatives, natural gas, wood and radioactive atoms (uranium) [6].

Renewable Energy Resources:- Renewable energy resources are the ones that are persistently available and renewing itself with the time. Industrialization and increasing world population has remarked the use of renewable energy resources. Solar power, wind power, biomass, tide power, wave power, geothermal power is known ones [7].

II. LITERATURE REVIEW

Dodi Garinto et al. [1], this paper presents another 3-stage 3-level 3-wire AC-DC converter structure for wind energy change frameworks (WECS). The multi-channel converter design with a stage moving standard is proposed to tackle the specialized difficulties of future MV PMSG WECS with 5 – 20 MW power rating. Too, the Discontinuous



Conduction Mode (DCM) activity is utilized to accomplish a minimal expense arrangement and to diminish the control intricacy. If there should be an occurrence of 5 – 20 MW yield power levels, the information furthermore, yield swell flows at the inductance and capacitance channels are concentrated on utilizing PSPICE reproduction investigation. Recreation results show that the information and result swell flows are diminished fundamentally, which lead to more modest inductance and capacitance esteems so high-effectiveness, high-unwavering quality and light-weight WECS can be figured it out.

Shailendra Kumar Tiwari et al. [2], have created a basic disordered heartbeat position regulation to diminish the pinnacle EMI in SMPS. The proposed a basic confused transporter era method to enhance the productivity of DC-DC support converters, and lessened the exchanging misfortunes and EMI adequately. It has made a randomization strategy consolidating randomized PWM and Sigma Delta PWM advances for led EMI decrease in fly back converter in the scope of 10 to 20 dB μ V over RPWM modulators. Pseudo-arbitrary succession generator is utilized to give programmed dynamic dithering to evacuating undesired sit still tones in the yield of the Sigma Delta Modulator (SDM).

Miloud Rezkallah et al. [3], have demonstrated and examined the consonant security of three stage inverter in a power framework. This approach is helpful for the investigation of consonant shakiness in a power electronic based power framework. The consequences of non-straight time area reenactments and hypothetical examination in the recurrence space in view of the linearized models of inverters with inward control circles approve the viability of this plan. This paper presents the modeling, simulation and control strategy of a hybrid power system (HPS) integrating a wind energy conversion system (WECS), a solar photovoltaic system (SPV) and a biodiesel generator (BDG) as well as a storage battery designed to ensure power reliability under all various weather conditions.

José Antonio Aguado et al. [4], the model includes wind turbine, photovoltaic panels, permanent magnet synchronous generator (PMSG), power converters and maximum power point tracking (MPPT) controllers. Perturb and observe (P&O) algorithm is used to extract the maximum power from PV and Tip speed ratio (TSR) controller for the WECS. The dynamic behavior of the proposed HPS is examined under different conditions based on wind speed variation and solar radiations. The BDG is involved only for backup when the battery state of charge (SOC) is less than 45%. A Hysteresis technique is used to control the BDG startup on based on the variation of the battery SOC. The developed HPS consists of a 50 W photovoltaic panel, 300 W wind turbine, 400 W biodiesel generator and 200 Ah/24 V battery. The resultant model offers a good strategy to ensure power reliability under all conditions using renewable energies.

Mostafa Farrokhbadi et al. [5], solar electric or photovoltaic technology is one of the biggest renewable energy resources to generate electrical power and the fastest growing power generation in the world. The environmental effects such as temperature, irradiation, special characteristics of sunlight, dirt, shadow, and so on affect the performance of the photovoltaic (PV) system. Changes in insolation on panels due to fast climate changes such as cloudy weather and increase in ambient temperature can reduce the PV cell output power. The PV system has poor utilization efficiency so it operates at the maximum power points (MPPs). The main aim of this work is to analyze the interface of photovoltaic system to the load, the power electronics device and the method to track the maximum power points (MPPs) of the solar panel.

Aquib Jahangir et al. [6], however, most of the PV power generation comes from grid-connected installations, where the power is fed in the electricity network. In fact, it is a growing business in developed countries such as Germany which is world leader in PV power generation followed by Spain, Japan, USA and Italy. On the other hand, due to the equipment required, PV power generation is more expensive than other resources. Governments are promoting it with subsidies or feed-in tariffs, expecting the development of the technology so that in the near future it will become competitive. Increasing the efficiency in PV plants so as to increase the power generated is a key aspect, as it will increase the incomes, reducing the cost of the power generated, cost approaching the cost of the power produced from other sources. Solar cells are the basic components of photovoltaic panels. Most are made from silicon even though other materials are also used. Solar cells take advantage of the photoelectric effect: the ability of some semiconductors to convert electromagnetic radiation directly into electrical current. The charged particles generated by the incident radiation are separated conveniently to create an electrical current by an appropriate design of the structure of the solar cell.

III. HBBRID ENERGY SYSTEM

Hybrid energy system is the combination of two energy sources for giving power to the load. In other word it can characterized as "Energy framework which is manufactured or intended to separate power by utilizing two energy

sources is called as the mixture energy framework." Hybrid energy framework has great unwavering quality, effectiveness, less discharge, and lower cost. In this proposed framework sunlight based and wind control is utilized for producing power. Sun powered and wind has great focal points than other than some other non-ordinary energy sources. Both the energy sources have more prominent accessibility in all territories. It needs bring down cost. There is no compelling reason to discover unique area to introduce this framework [5].

A. Solar Energy

Solar energy is that energy which is gets by the radiation of the sun. Sun oriented energy is available on the earth ceaselessly and in plenteous way. Sun oriented energy is uninhibitedly accessible. It doesn't deliver any gases that mean it is without contamination. It is reasonable in taken a toll. It has low upkeep cost. Just issue with nearby planetary group it can't deliver energy in terrible climate condition. Be that as it may, it has more prominent productivity than other energy sources. It just needs beginning speculation. It has long life expectancy and has brought down emanation [6].

B. Wind Energy

Wind energy is the energy which is extracted from wind. For extraction we use wind mill. It is renewable energy sources. The breeze energy needs less cost for age of power. Support cost is likewise less for wind energy framework. Wind energy is available very nearly 24 hours of the day. It has fewer outflows. Beginning expense is likewise less of the framework. Age of power from wind is rely on the speed of wind streaming. The real impediments of utilizing free sustainable power source assets are that inaccessibility of energy forever. For conquering this we utilize sun oriented and wind energy together. With the goal that any one wellspring of energy falls flat other will deal with the age. In this proposed framework we can utilize the two sources join [7]. Another way is that we can utilize any one source and keep another source as a remain by unit. This will prompts congruity of age. This will make framework solid. The primary detriments of this framework are that it needs high introductory cost. But that it is dependable, it has fewer outflows. Kept up cost is less. Life expectancy of this framework is more. Proficiency is more. A principle preferred standpoint of this framework is that it gives constant power supply.

IV. DESIGN OF HYBRID ENERGY SYSTEM

For design of the hybrid energy system we need to find the data as follows

A. Data required for Solar System:

1. Annual mean daily duration of Sunshine hours
2. Daily Solar Radiation horizontal (KWH/m²/day)

B. Data required for Wind System:

1. Mean Annual Hourly Wind Speed (m/sec)
2. Wind Power that can be generated from the wind turbine

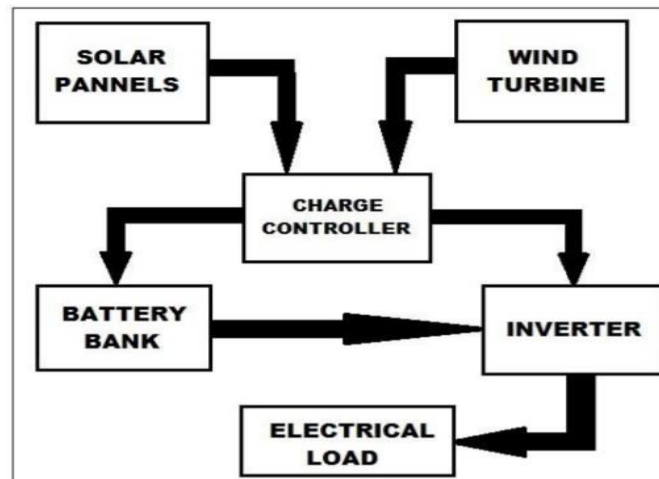


Figure 1: Block graph of Hybrid energy age framework

Above figure demonstrates the square outline of the cross breed control age framework utilizing wind and sunlight based power. This square outline incorporates following pieces.

- i. Solar panel
- ii. Wind turbine
- iii. Charge controller

(i) Solar panel

Solar panel is use to convert solar radiation to the electrical energy. The physical of PV cell is very similar to that of the classical diode with a PN intersection framed by semiconductor material. At the point when the intersection retains light, the energy of consumed photon is exchanged to the electron proton arrangement of the material, making charge bearers that are isolated at the intersection [8]. The charge bearers in the intersection area make a potential slope, get quickened under the electric field, and circle as present through an outer circuit. Sun powered exhibit or board is a gathering of a few modules electrically associated in arrangement parallel blend to produce the required current and voltage. Sun based boards are the medium to change over sun oriented power into the electrical power.

(ii) Wind turbine

Wind turbine is that framework which removes energy from twist by pivot of the sharp edges of the breeze turbine. Fundamentally wind turbine has two composes one is vertical and another is even. As the breeze speed builds control age is additionally increments. The power produced from wind isn't ceaseless its fluctuating. For acquire the non-fluctuating force we need to store in battery and after that give it to the heap.

(iii) Charge controller

Charge controller has basic function is that it control the source which is to be active or inactive. It all the while charge battery and furthermore offers energy to the heap. The controller has over-charge security, cut off, post perplexity assurance and programmed dump stack work. It additionally the capacity is that it ought to fluctuate the power according to the heap request. It include the both the power with the goal that the heap request can satisfy. Also, when control isn't producing it should remove control from battery and offer it to the heap.

V. AC-DC CONVERTER

The applications of high step up AC-DC full bridge converters are intensity discharge lamp ballasts for automobile headlamps, fuel-cell energy conversion systems, solar-cell energy conversion systems, battery backup systems for uninterruptible power supplies (UPS) etc. Here proposing a new single stage high step up AC-DC full bridge converter topology that features simple power and control circuitry. PWM control is used to control the switching action of the switches. Performance of the proposed converter under steady state analysis in continuous conduction mode is discussed in detail. Emphasis is given on demonstrating the operating principle, modes of operation, and derives circuit equation. The contents of this paper includes Proposal of a new single stage high step up AC-DC full bridge converter topology that features simple power and control circuitry.

- 2) Full Bridge AC-DC converter (FB) which consists of four MOSFET switches that are built-in anti-parallel diodes
- 3) Performing the steady state analysis of the proposed converter in continuous mode of operation.
- 4) Analyzing the open loop and c10 seed loop simulation results of AC-DC full bridge converter.

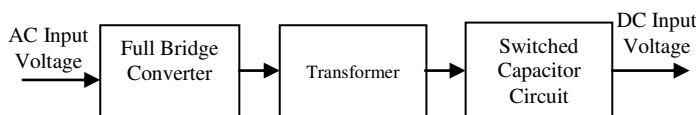


Figure 2: Block Diagram of Proposed AC-DC Convert

The block diagram of AC-DC converter is shown in Figure 2, gives a constant ac input voltage to the MOSFET full bridge circuit, and that output is given to the primary side of the coupled inductor with low magnetizing inductance. The secondary side of the coupled inductor is fed to the switched capacitor circuit and obtains high voltage dc output voltage. Driver circuit is essential due for giving power to control signal for driving MOSFET.

VI. CONCLUSION

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 hybrid power generation system which comprises of PV arrays, wind



turbines with battery banks and power charge controller units has been discussed in this thesis to achieve a cost effective system configuration. Practical investigations are performed to examine the effect of source impedance on a hybrid wind and PV power system. Because of voltage drop in power sources, both energy sources cannot charge a battery simultaneously after initial charging.

REFERENCES

- [1] Dodi Garinto, Dena Hendriana, Harki Apri Yanto and Tole Sutikno, "A New 3-Phase 3-Wire 3-Level AC-DC Converter for Wind Energy Conversion Systems", IEEE 2020.
- [2] Michael Kyesswa, H'useyin C, akmak, Uwe K'uhnappel, Veit Hagenmeyer, "Dynamic Modeling of Wind and Solar Power Generation with Grid Support for Large-Scale Integration in Power Systems", IEEE PES Innovative Smart Grid Technologies Europe (ISGT-Europe), IEEE 2020.
- [3] Shailendra Kumar Tiwari, Bhim Singh and Puneet Kr. Goel, "Design and Control of Autonomous Wind-Solar System With DFIG Feeding 3-Phase 4-Wire Loads", IEEE Transactions on Industry Applications, Vol. 54, Issue 2, PP. No. 1119 – 1127, IEEE 2018.
- [4] Miloud Rezkallah, Abdelhamid Hamadi, Ambrish Chandra and Bhim Singh, "Design and Implementation of Active Power Control With Improved P&O Method for Wind-PV-Battery-Based Standalone Generation System", IEEE Transactions on Industrial Electronics, Vol. 65, Issue 7, PP. No. 5590-5600, IEEE 2018.
- [5] José Antonio Aguado, Antonio José Sánchez Racero and Sebastián de la Torre, "Optimal Operation of Electric Railways With Renewable Energy and Electric Storage Systems", IEEE Transactions on Smart Grid, Volume 9, Issue 2, PP. No. 993-1001, March 2018.
- [6] Mostafa Farrokhbadi; Bharatkumar V. Solanki; Claudio A. Canizares and Kankar Bhattacha, "Energy Storage in Microgrids: Compensating for Generation and Demand Fluctuations While Providing Ancillary Services", IEEE Power and Energy Magazine, Vol. 15, Issue 5, PP. No. 569-578, Sept.-Oct. 2017.
- [7] Aquib Jahangir and Sukumar Mishra, "Autonomous Battery Storage Energy System Control of PV-Wind Based DC Microgrid", 2nd International Conference on Power, Energy and Environment: Towards Smart Technology (ICEPE), IEEE 2018.
- [8] Zhengnan Cao, Fergal O'Rourke, William Lyons, "Performance modelling of a small-scale wind and solar energy hybrid system", Signals and Systems Conference (ISSC), 28th Irish, IEEE 2017.
- [9] M. Y. Zargar, M. U. D. Mufti, S. A. Lone, "Modelling and control of wind solar hybrid system using energy storage system", International Conference on Computing Communication and Automation (ICCCA), pp. 965-970, 2016.
- [10] A. Anurag, S. Bal, S. Sourav, M. Nanda, "A comprehensible review of maximum power point tracking techniques for photovoltaic systems", International Journal of sustainable energy, vol. 35, pp. 478-501, 2016.
- [11] R. A. Gupta, Bhim Singh and Bharat Bhushan Jain, "Wind Energy Conversion System using PMSG", International Conference on Recent Developments in Control, Automation and Power Engineering (RDCAPE), IEEE 2015.
- [12] J. Plaza Castillo, C. Daza Mafiolis, E. Coral Escobar, A. Garcia Barrientos, R. Villafuerte Segura, "Design Construction and Implementation of a Low Cost Solar-Wind Hybrid Energy System", IEEE Latin America Transactions, vol. 13, no. 10, pp. 3304-3309, Oct. 2015.
- [13] A. V. P. Kumar, A. M. Parimi, K. U. Rao, "Implementation of MPPT control using fuzzy logic in solar-wind hybrid power system", IEEE International Conference on Signal Processing Informatics Communication and Energy Systems (SPICES), pp. 1-S, 2015.
- [14] T. H. Rini, M. A. Razzak, "Voltage and power regulation in a solar-wind hybrid energy system", IEEE International WIE Conference on Electrical and Computer Engineering (WIECON-ECE), pp. 231-234, 2015.
- [15] H. Patsamatla, V. Karthikeyan, R. Gupta, "Universal maximum power point tracking in wind-solar hybrid system for battery storage application", International Conference on Embedded Systems (ICES), pp. 194-199, 2014.



INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.118



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

9940 572 462 6381 907 438 ijirset@gmail.com



www.ijirset.com

Scan to save the contact details