



---

# Hybrid Energy Storage System using Pv-Wind Source for Power Quality Management

---

M.K.Saravanan<sup>1\*</sup>, P.Rajalakshmi<sup>2</sup>

<sup>1\*</sup>PG student, Sri Chandrasekarendra Saraswathi Viswa Maha Vidhyalaya

<sup>2</sup>Assistant Professor, Sri Chandrasekarendra Saraswathi Viswa Maha Vidhyalaya

**Received:** 16 March 2022

**Accepted:** 02 June 2022

**Published:** 01 July 2022

*Abstract: New natural power sources (HRES) like Photovoltaic (PV) system, wind turbine (WT) and battery energy capacity system (BESS) into the grid associated framework have been massively expanding its significance to satisfy the worldwide energy need. The coordinated plan mostly aims around power quality (PQ) issues because of the non-linear load condition. In this situation, dynamic power filters plays an important and huge part for development in power quality. Also, at transmission ground, there is a high necessity to control reactive power and voltage stability. Ordinarily, passive and dynamic filters (shunt and series channels) were utilized for the advancement of power quality. However, they experienced the issues like resonance, fixed compensation and other PQ issues. In this manner, to limit these issues, a cross combination of filters, it is intended to utilize passive and dynamic filters. The proposed framework is executed in MATLAB/Simulink stage to improve the performance during voltage drop, current drop, real power, reactive power and with regards to total harmonic distortions (THD's).*

**Keywords:** Solar PV, Maximum Power Point Tracking Wind Energy, Power Quality, PIC Controller, PWM.

## 1. INTRODUCTION

There is a developing interest in Renewable energy all over the planet. New techniques for activity and the board of power network for expanding number of sustainable power sources and circulated generators all together to keep up with or even to further develop the power supply unwavering quality also, quality .It is a moving assignment to incorporate RES into power lattice foundation due to its irregular nature.

The power electronic innovation assumes a conspicuous part in dispersed age and coordination of RES into electrical matrix. Nonetheless, the huge utilization of force hardware based hardware and nonlinear burdens at PCC create consonant flows, which may deteriorate the nature of force. To control the inverter so that to greatest use environmentally friendly power with framework a



customary PI control system is introduced in paper [1-3]. Dynamic Power Filters (APF) are massively used to repay currentmusic and burden unbalance. The Active power channel topology[4] can be associated either in series or shunt and additionally in mix of both.

Environmental change has turned into a significant ecological worry lately as Green House Gas (GHG) outflows have expanded [5]. Subsequently, it has been encouraged to search for elective energy sources that can create power [5], and wind and sun based energy have been shown to be compelling in delivering financially less power [6]. In more established times, just sunlight based energy was utilized for producing power. Utilizing just sun based energy frameworks is having a few difficulties. These frameworks are not equipped for creating greatest power during overcast or stormy days [6]. Individuals who utilize this framework will be without power until the battery has been released [6]. Most extreme power can be created by joining sunlight based and wind energy creation methods [6].

The system presented in this paper is based on various optimization techniques for enhancing the efficiency of the system, which can provide continuous power at lower costs, thus reducing the financial pressure on people living in rural areas. Integrating solar and wind energy into hybrid power generation systems will minimize induced power volatility relative to single Variable Renewable Energy (VRE) systems, increasing overall system efficiency and reliability [7].

#### **Contribution:**

- (i) In this paper, a hybrid and effective framework for bridling power is developed based on hybrid source and a blend of sun oriented and wind energy
- (ii) The point of this paper is to track down the answer for the difficulties in settling power quality issues and improving power proficiency, alongside the attention on THD.

#### **A. Converters:**

A converter is a gadget that changes electric power from DC over to AC in an interaction called reversal, and additionally changing over from AC to DC is a cycle called amendment. The converter size, which is a choice variable, alludes to the inverter limit, meaning the greatest measure of AC power that the gadget can create by altering DC power. The rectifier limit, which is the most extreme measure of DC power that the gadget can deliver by correcting AC power as a level of the inverter limit, has been indicated. The last actual properties of the converter are its reversal and amendment efficiencies, which were thought to be steady. The inverter and rectifier efficiencies were thought to be 90% and 85% for this review.

#### **B. Wind Generation:**

In this setup, wind ages taken is steady speed with pitch control turbine. In the proposed conspire because of effortlessness nature an enlistment generator is utilized in wind energy source. Wind Energy Conversion Systems show inconstancy in their result power therefore it represents a parcel of difficulties to the utility administrators as far as the power framework network uprightness for example power framework security power framework solidness and power quality[8].

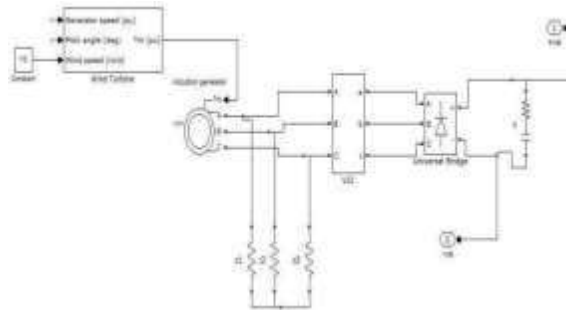


Figure 1: Simulink model of a wind energy generating system

### C. Shunt Active Power Filter (DSTATCOM)

The target of SAPF is to limit the bending in power supply utilizing four fundamental parts are DC capacitor, Voltage source inverter (VSI), Coupling transformer, Reactor. A Distribution Static Compensator is in short known as D-STATCOM. It is a power electronic converter based gadget used to safeguard the dissemination transport from voltage unbalances. It is associated in shunt to the dispersion transport by and large at the PCC. D-STATCOM is utilized to repay load current distortion by infusing equivalent, however oppose inverse compensating current. The active filter has an extra capacity to direct the distribution line voltage through changing receptive power.

### Existing System

The schematic chart of implemented framework, which comprises of RES associated with dc-connection of a network communicating inverter with non-direct burden as displayed in fig 2.

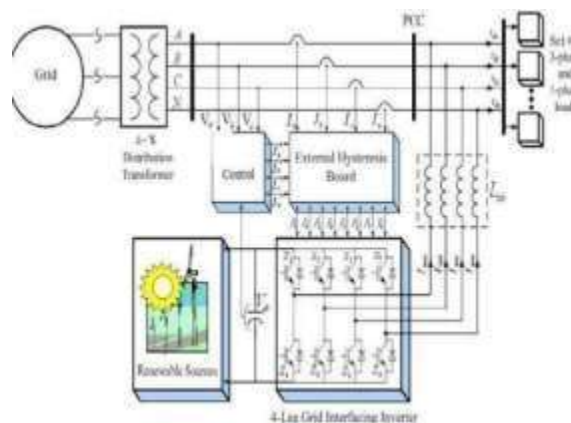


Figure 2: Existing system model with 4 Leg Inverter

Network is associated with venture down transformer with decrease voltage level for circulation side. VSI interfaces the environmentally friendly power sources to lattice and furthermore conveys

the produced power as it is considered as a vital component of Distribution Generation (DG) framework. The RES might be DC source or AC source with rectifier coupled to dc connect. Power molding (dc/dc or ac/dc) is expected for power produced from wind energy sustainable source in view of variable ac power from variable breeze turbine before it was associated with dc connect. The dc capacitor permits autonomous control of converters on either side of dc-connect and decouples the RES from the framework.

### Proposed System

A control method for an independent sun powered photovoltaic (PV) wind hybrid framework is carried out in this paper. The proposed framework manages the discontinuous idea of the energy produced by the PV array and it likewise gives power quality improvement. The PV array is coordinated through a DC-DC help converter and controlled utilizing a greatest power point following (MPPT) calculation to get the most extreme power under fluctuating working circumstances.

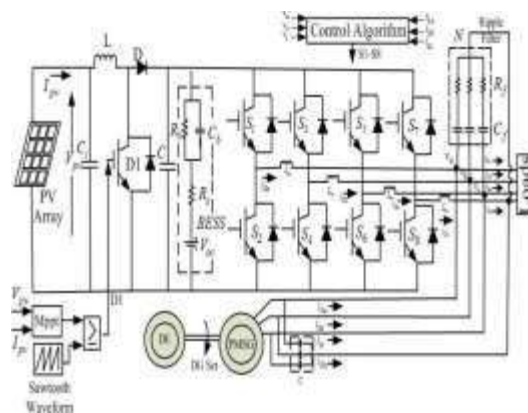


Figure 3: Proposed system model with Hybrid Energy System

The battery energy capacity framework (BESS) is incorporated to the Wind energy set for the coordinated load management and power stream inside the framework. The induction based control method is utilized for load adjusting, harmonics reduction and reactive power remuneration under three stage four-wire straight and nonlinear load. A Voltage Source Converter [9-10] (VSC) is a power electronic gadget that is associated in shunt to the system. The DC voltage across the capacity gadgets can be changed over into a bunch of three phase AC yield voltages by VSC. It has also able to create or ingests reactive power.

## 2. RESULTS AND DISCUSSION

The Simulink design for hybrid source system for power quality management and energy storage process is implemented using MATLAB.

Z

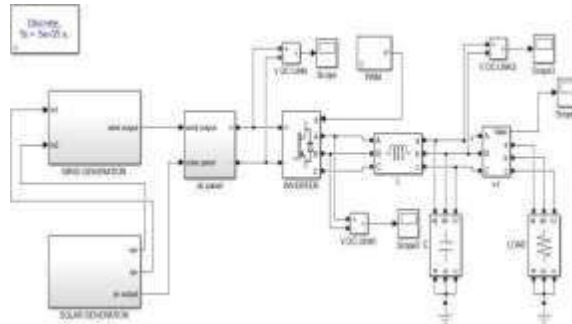


Figure 4: Simulation for the proposed system

Output from the BLDC motor with stator current and emf.

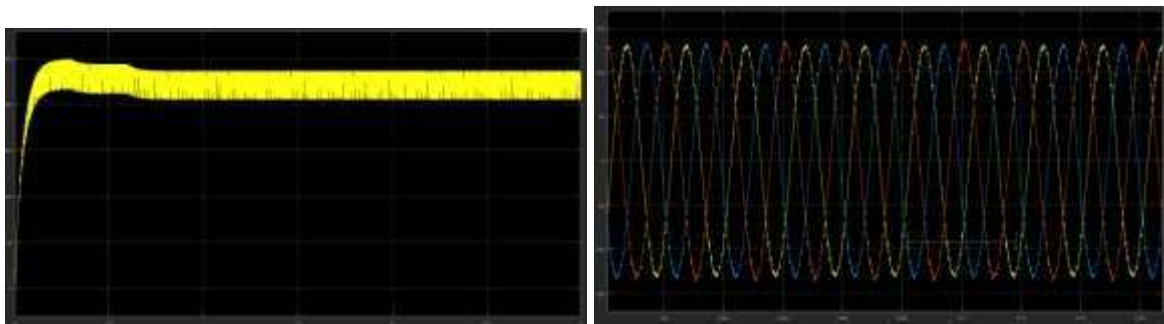


Figure 5: Boost and Rectified DC output voltage

By simulation, the calculation is done and it is proved. The voltage issue is compensated by using hybrid energy source by measuring the grid voltage which is shown in the above diagram

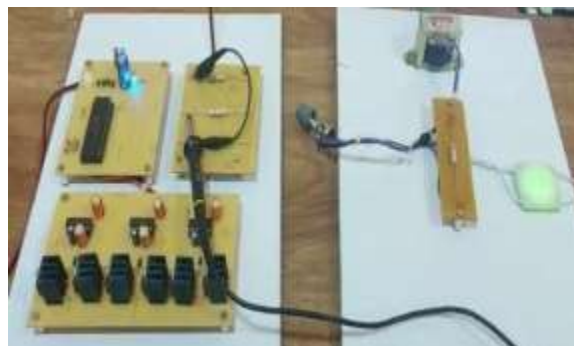


Figure 6: Hardware kit model for proposed system with the fault



Figure 7: Hardware kit model for proposed system after clearing the fault

### 3. CONCLUSION

There exists an overall concern in regards to the energy security and maintainable improvement of energy across the globe. The job of environmentally friendly power has consequently become more huge. The created world is as of now on target for diminishing the petroleum derivative use and fostering the areas of sustainable power innovations.

The plan of independent electric power supply framework for a model local area has been directed in light of the examination of wind energy and sunlight based energy possibilities of the area student.

### 4. REFERENCES

1. Roshan Haste, Power Quality Improvement in Grid Connected Renewable Energy Sources at Distribution Level, 2014 International Conference on Circuit, Power and Computing Technologies [ICCPCT]
2. Mukhtiar Singh, "Grid Interconnection of Renewable Energy Sources at the Distribution Level with Power-Quality Improvement Features", IEEE transactions on power delivery, vol. 26, no. 1, January 2011.
3. Roshan Haste, "Power Quality Improvement in Grid Connected Battery Storage Energy Source at Distribution Level", ISSN 2231- 1297, Volume 4, No 1, pp. 27-34, 2014.
4. M.EI-Habrouk, M. K. Darwish and P. Mehta, " The Active power filters: A review" IEEE proceedings on Electric power applications, Vol 147, No.5,pp 403 - 413, September 2000
5. Y. Kassem, H. Çamur, and R. A. F. Aateg, "Exploring solar and wind energy as a power generation source for solving the electricity crisis in Libya," Energies, vol. 13, no. 14, p. 370, 2020.
6. Manikandan, A., & Pradeep, S. (2017). IoT Based Electricity Theft Detection. International Journal of Control Theory and Applications, 10(12), 211–215.
7. Haroon Ashfaq, Surendra Kumar Tripathi, " Wind Energy Conversion System Integrated with Grid under Variable Speed Scenario", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Vol. 4, Issue 2, February 2015.



8. T.R. Ayodele, A.A. Jimoh, J.L Munda, J.T Agee,” Challenges of Grid Integration of Wind Power on Power System Grid Integrity: A Review” in International Journal of Renewable Energy Research T.R. Ayodele et al., Vol.2, No.4, 2012.
9. Manikandan, A., & Nirmala, V. (2015). A Low Cost Thermoelectric Refrigerator. International Journal of Applied Engineering Research, 10(55), 3097–3101.
10. J. P. Pinto, R. Pregitzer, L. F. C. Monteiro, and J. L. Afonso, “3-phase 4-wire shunt active power filter with renewable energy interface,” presented at the Conf. IEEE Renewable Energy & Power Quality, Seville, Spain, 2007.