# Hybrid Renewable Power Generation Scheme for Grid Integration

**K.Sakthivel, V.Jayalakshmi**

***Abstract:*** ***In this research work, a novel grid reconciliation scheme for a hybrid electric power generation plot utilizing PV power generation and Synchronous generator based breeze (wind) power generation is proposed here. In this proposed work, MPPT is obtained and tracked with the help of Fuzzy Logic Controller for Wind turbine and P&O methodology for photovoltaic systems. The wind power and the photo voltaic source are conveyed to a CUK DC converter connect and a DC to AC three stage Multilevel inverter (13 Level) is utilized to transfer control into the framework(grid) and a novel control scheme is taken for sinusoidal current infusion at the grid integration.***

***Keywords: hybrid electric power generation, power generatio, MPPT, CUK DC.***

## I. INTRODUCTION

These days, the decent variety in vitality age sources and synchronous utilization of a few vitality sources in a single framework has made crossover vitality frameworks more appealing. Mixture vitality frameworks exploit distinctive highlights of various vitality sources in control electronic applications, for example, increase in joining, dependability, solidness, control taking care of ability and productivity in contrast with single vitality source frameworks. Consequently the utilization of various vitality age sources with various I-V qualities and changing over the obtained vitality into a controlled voltage to take care of the heap demand in the crossover vitality frameworks has noted on the multi-input DC-DC converters. In such half breed vitality frameworks which utilize a few vitality sources, rather than utilizing various single DC-DC converters to exchange control from each info source to the yield stack, a multi-input converter can be utilized. By incorporating a multi-input converter the size, cost and intricacy of the framework can be lessened. Another favorable position of multi-input converters is utilizing vitality stockpiling gadgets as the information source. As vast majority of these vitality sources provide low voltage, so high advance up strategies are required to expand the voltage gain. To expand the voltage increase, numerous strategies have been proposed, for example, coupled inductors, disengaged transformers, arrangement capacitors in the power stream way and exchanged diode-capacitor structures. By utilizing these techniques, the issues related with the outrageous working obligation cycles in the ordinary lift converter can be illuminated and the converter execution is upgraded.

As of late, in light of various applications, a few secluded [4-6] and non-disengaged [7-9] topologies with different input converters are proposed.

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The presence of transformers alongside extra fringe hardware builds the volume, cost and plan intricacy of segregated converters. Subsequently, in a few applications in which disengagement isn't required, non-confined converters are more fitting.

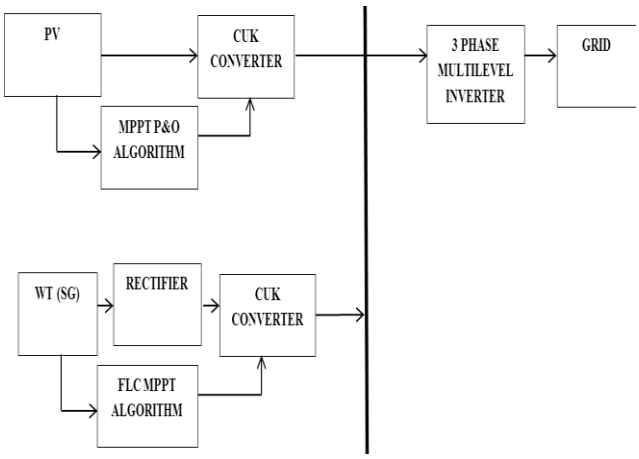


**Fig. 1 Block Diagram of Proposed system**

## II. APPROACH

As of late, based on various applications, a few separated [4-6] and non-detached [7-9] topologies on multi-input converters are proposed. The presence of transformers alongside extra fringe hardware expands the volume, cost and plan many-sided quality of segregated converters. In this manner, in a few applications in which detachment isn't required, non-confined converters are more proper. As of late, the utilization of non-confined high advance up several input DC-DC converters in various applications has been expanding and difficulties from various viewpoints have been tended to in writing. Some critical ones are portrayed as takes after: diminishing the quantity of parts, adaptability to broaden the quantity of information sources, giving force stream ways to ESS, expanding voltage gain and utilizing delicate changing techniques to improve effectiveness.

In [1] several input converter with combined inductors is presented which utilizes photovoltaic and battery as information sources and to build the voltage increase, some photovoltaic boards are put in arrangement with the yield. In the present system, the quantities of intensity organize changes are lessened and by giving delicate changing condition to the converter switches, the proficiency is upgraded. Be that as it may, in this converter nearly the entire power stream way is imparted to the two sources of info.

Along these lines, the task of the converter to a great degree relies upon the data sources with the end goal that battery and PV are constantly put in control stream way. For instance, in circumstances in which battery do not be charged or released, some measure of vitality streams to battery, causing expanded conduction misfortunes. To control this converter, dependably the power status of the data sources must be checked. Additionally, because of the utilization of inductor, multi transformer, their dimensions are expanded. A multi-port converter is used, which utilizes two lift converters with combined inductors to give the desired voltage gain to each information source. Additionally two dynamic clasp circuits are utilized to reuse the spillage inductance vitality and to give delicate exchanging condition. The converter adopts both the charging/releasing way to diminish the quantity of converter parts by utilizing a bidirectional power stream way. In this converter with combined inductors are put in arrangement to upgrade the voltage gain. Be that as it may, this strategy makes the power administration to a great degree rely upon the power status of each information. For instance, in the circumstance in which one of information sources does not give vitality, since two converters are set in arrangement with each other, the usefulness of the converter would debase. Consequently, the fundamental switching state of the one converter must increment to make up for the absence of the other info. Or on the other hand, in the circumstance in which battery does not have to charge/release, the power stream of the Photo voltaic source to the yield goes through a piece of battery area circuit, which makes flowing misfortunes and expanded control intricacy. Likewise, utilizing a bidirectional power way to charge/release the ESS with presence of numerous components, creating additional misfortunes and furthermore in light of utilizing five influences switches the cost and plan intricacy of this converter is expanded.

## III. COMPONENTS OF PROPOSED SYSTEM

One of the elements is to be considered in plan of the multiple input converters is, decreasing the quantity of the converter segments and one answer for explain this test is, sharing the converter parts. Appropriately, another multi-port DC-DC converter is discussed in this article which has one separate stage for each information with the end goal that the assignment of the parts is changed amid each working modes. Accordingly, a few parts are partaken in various working modes, prompting a lessened in segment tally.

### A. CUK Converter

A driver is an electrical circuit or other electronic segment used to control another circuit or part, for example, a powerful transistor, Liquid Crystal Display (LCD), and various others. They are typically used to manage current coursing through a circuit or to control different factors, for example, different segments, and a few gadgets in the circuit. The term is regularly utilized, for instance, for a particular incorporated circuit that controls high-control switches in exchanged mode control converters. An intensifier can likewise be viewed as a driver for amplifiers, or a voltage controller that keeps a connected part working inside a wide scope of info voltages.

### B. 3-Phase Multi-Level Inverter

The existing S-Type inverter contains many switches and voltage sources. Multilevel level inverter is most used power converter for high power application. The basic arrangement of the 13-level inverter is to get voltage from a couple of levels of DC voltages. The controller gives control through switches using PWM methodology. The 13-level inverter is simulated using MATLAB/Simulink.

### C. Fuzzy Logic Converter

Fuzzy controllers are used in the tracking of the MPPT for wind energy systems. The system will be robust and relatively simple. It does not require more knowledge for the exact model.

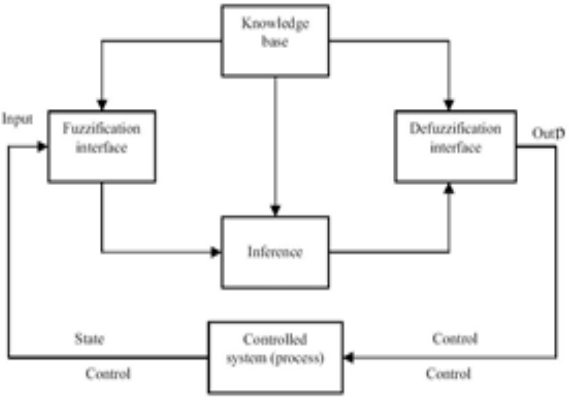


**Fig. 2 FLC algorithm block representation**

On other hand it does not require the complete knowledge of the operation of the wind system by the designer.

## IV. SIMULATION OF PROPOSED SYSTEM

The proposed system of research work is simulated in MATLAB/Simulink Simulation Software. The main simulation diagram is as shown in the figure 3.

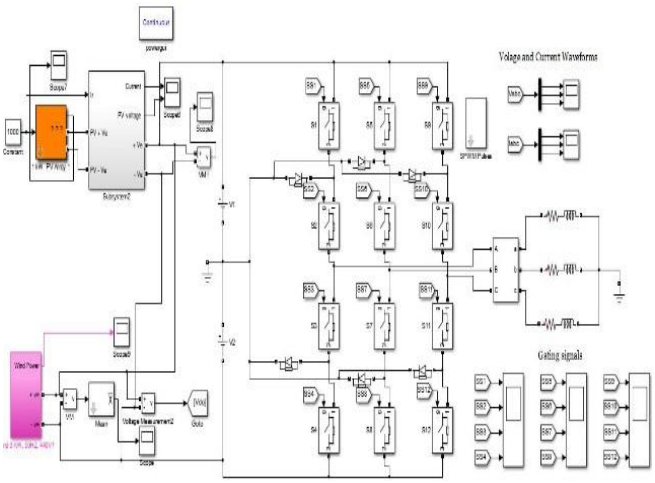


**Fig. 3 Simulation of proposed system**

The solar pv system is also modeled in this software is as shown in the figure 4.

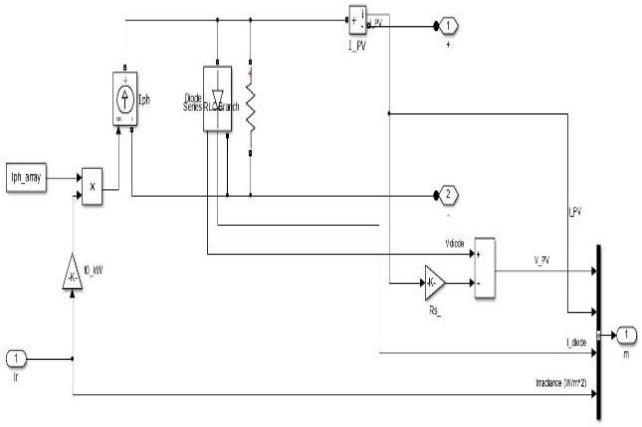

**Fig. 4 Simulation diagram of Solar PV system**

The wind power generation is using PMSG generator for power generation is modeled as shown in the figure 5.

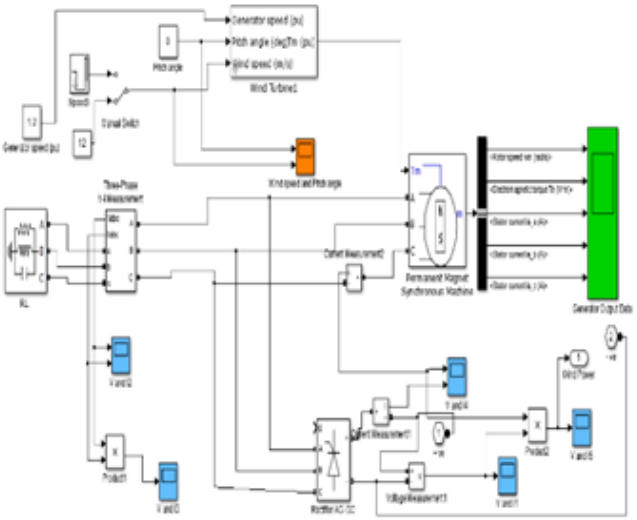

**Fig. 5 Wind power generation of simulation model**

The proposed MPPT algorithm with FLC technique is as shown in the figure 6.

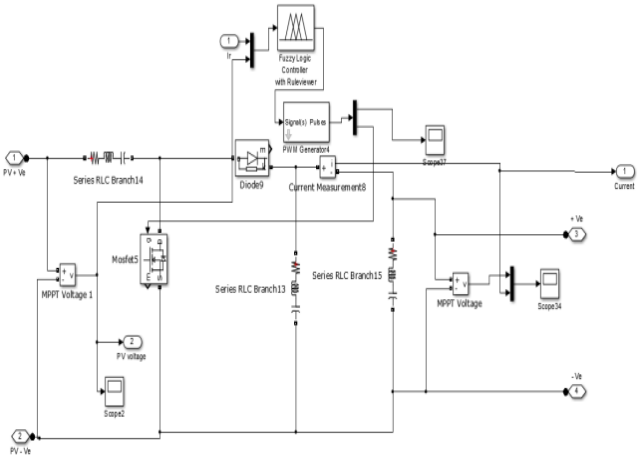

**Fig. 6 Simulation model of MPPT with FLC technique**

The DC power input is converted into AC power output using proposed Multilevel inverter. The multilevel inverter used here is as modeled in the figure shown in 7.

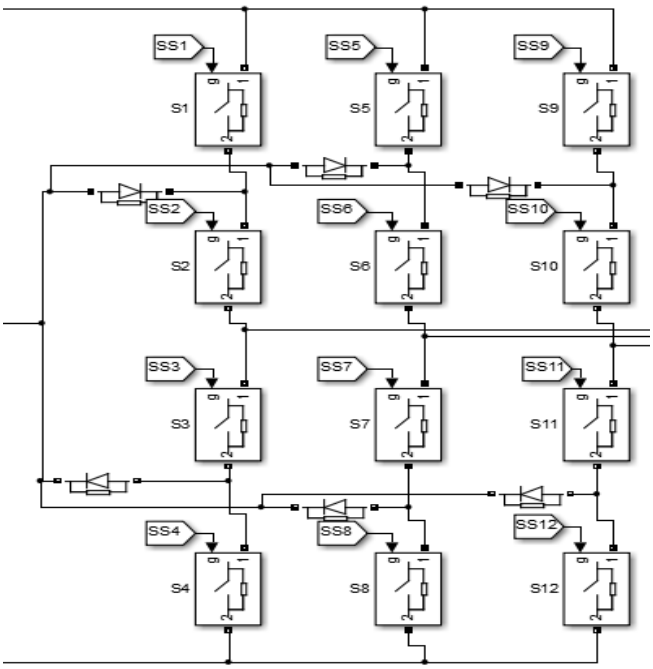


**Fig. 7 Simulation model of proposed multilevel inverter**

The proposed system consists of the following components modeled in the simulation software.

## V. SIMULATION OUTPUT WAVEFORM AND RESULTS

The modeled proposed system is successfully compiled in the simulation software and the simulation output is observed. The output voltage of PV system is as shown in the figure 8.

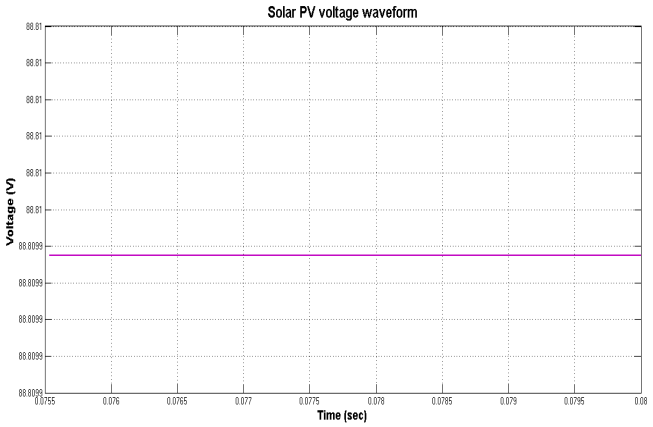


**Fig. 8 Solar PV Voltage output**

The output voltage waveform of proposed wind power system is as shown in the figure 9.


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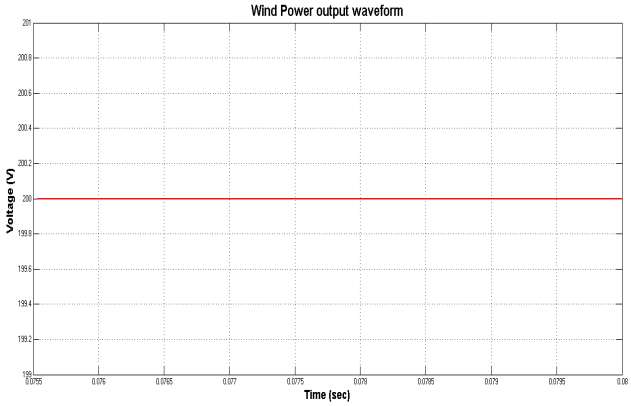


**Fig. 9 Wind power output voltage waveform**

The solar power is enhanced to the main 200 voltage by using FLC mppt controller the output of MPPT controller is as shown in the figure 10.

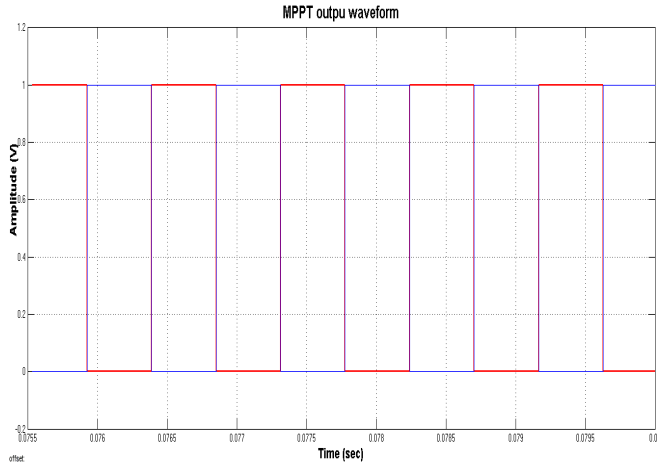


**Fig. 10 MPPT output pulse for boost converter**

Then the DC output voltage is converted into AC by using proposed multilevel converter. The output is generated with the help of SPWM pulse given to semiconductor devices in the multilevel inverter. The SPWM wave is as shown in the figure 11.

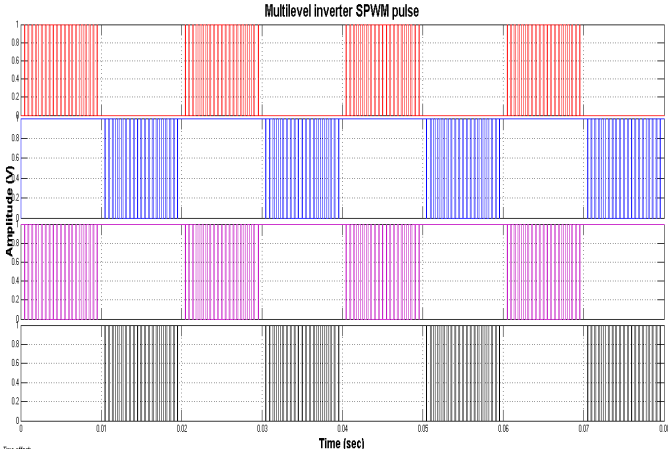


**Fig. 10 Multilevel inverter SPWM waveform**

By SPWM wave to the multilevel inverter the output generated is constant 5 level voltage as shown in the figure 11.

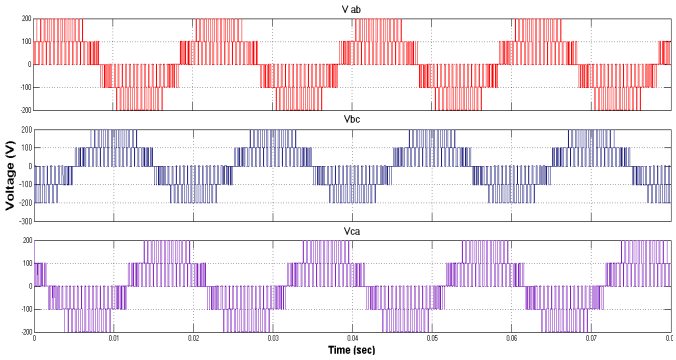


**Fig. 11 5 level voltage output waveform**

The current output of the grid is as shown in the figure 12. The voltage is maintained at amplitude of about 200 volt 5 level AC output.

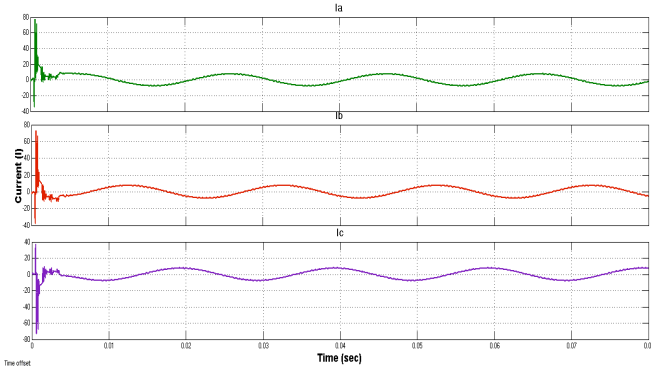


**Fig. 12 AC Current output waveform**

**Case 1: With MPPT FLC**

| PARAMETERS | Values |
|---|---|
| Solar Output Voltage (V) | 88.8 |
| Solar Output Current (A) | 2 |
| Solar Power Output (W) | 170 |
| Wind Output Voltage (V) | 88.8 |
| Wind Output Current (A) | 9 |
| Wind Power Output (W) | 880 |
| DC link Voltage(V) | 200 |
| AC output Voltage (V) | 200 |
| AC output Current (A) | 10 |
| AC output Power (w) | 2000 |

**Case 2: Without MPPT FLC**

| PARAMETERS | Values |
|---|---|
| Solar Output Voltage (V) | 88.8 |
| Solar Output Current (A) | 2 |
| Solar Power Output (W) | 170 |
| Wind Output Voltage (V) | 88.8 |
| Wind Output Current (A) | 9 |
| Wind Power Output (W) | 880 |
| DC link Voltage(V) | 150 |
| AC output Voltage (V) | 150 |
| AC output Current (A) | 10 |
| AC output Power (w) | 1500 |

## VI. CONCLUSION

A new method of hybridized wind and solar renewable energy system with AC voltage output is as modeled and simulation is made. From the output from the previous section it can be concluded that the Solar and Wind system is coupled to get constant output voltage by boosting and inverting method. The constant 5 level 200 volt ac voltage is generated with fewer ripples and the current waveform is also generated to be an efficient way compared to inverter PWM circuit topology.

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