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# Investigation of Dual Input Based Z Source Converter for Solar Wind Application

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**Abstract:** High power production of Z source converter using the dual input concept. The traditional voltage source inverter functions like a step-down inverter, but the voltage is raised. As the current source inverter contains a step-up inverter, the voltage generated by the inverter is lower than that of the VSI. The proposed multi-input solar and wind-based power production feed the single Z source inverter in linear load. The photovoltaic has been designed by using semiconductor devices such as silicon, copper. Based on the device, the power will be produced. The wind supplies more power, but the maintenance cost is too high. The proposed two input sources, wind and combined solar power using the dc-dc converter, are given to the z source inverter for increased power. The switch is linked in series with the solar and wind energy supplies to enable the various modes of operation. The power will be checked at the output of the converter in MATLAB/SIMULINK software.

**Keywords:** Solar, Wind, Dual input, Z-source converter, inverter.

## 1. Introduction

Hybrid power is a combination of solar and wind renewable energy. In recent years the two inputs have been used to generate more power using the two converters, and they can be connected in series or parallel connections [1]. The proposed circuit has two sources, but the single converter is used to produce high power. The conventional voltage source inverter has acted as a step-down inverter, but the voltage is increased. The current source inverter has a step-up inverter, the voltage produced from the inverter decreased compared to VSI. The proposed wind and solar combined power are given to the z source inverter for high power [2].Because of the construction of the Z-source converter and the method utilized, the suggested converter has four ports that can be expanded to five ports. As an additional source, the switch topology of the converter allows for the definition of three duty cycles. They are used to control the output

voltage and input power of one of the two sources. The planned converter has novel frameworks for incorporating controlled variables source and the bidirectional port [6].The Z-source inverter (ZSI) topology allows for the elimination of numerous stages and the achievement of voltage boost and DC-AC power conversion in a single stage [7].As a consequence, a comparison study was conducted between a single-stage quasi-Z-source inverter (qZSI) and a standard two-stage inverter for photovoltaic (PV) applications based on a field-programmable gate array (FPGA) [8].

Moreover, Model Predictive Control (MPC) of dual-mode Z-source Inverters (ZSI) with islanded and grid-connected modes of operation. The MPC's major goals are direct decoupling power control in a grid-connected way and load voltage regulation in isolated mode [9]. The Z-source design includes a high-performance, low-cost inverter for photovoltaic installations. The traditional voltage-source and current-source inverters have evolved into the new Z-source Inverter [10]. The thorough analysis method in quasi Z-source converters that provide a wide range of primary side voltage and output side load control allows the multi-way application by evaluating buck and boost up operations with an efficient range of output power. It provides voltage management utilizing fuzzy logic for modified hybrid power sources through z-origin converters [11].

Further, the hybrid microgrid presented both AC and DC grids connected via a bidirectional Z-source converter. It is feasible to eliminate numerous conversion losses and enhance the overall efficiency of the microgrid using the suggested configuration [12]. Wind energy generation system with boost control based on the Z-source inverter. When the generator's low voltage is supplied in response to the low wind speed, the suggested method can effectively boost and create the desired output voltage [13].A grid-connected photovoltaic (PV) system based on a series Z-source inverter that proposes control strategies such as DQ theory, dc-link voltage control, and MPPT scheme is realized in a single-stage system achieves constant peak dc-link voltage and thus simplifies controller design in the inversion stage [14].For rural and distant places, a Z-Source inverter based on a solar power generation system is developed and built for feeding both dynamic (induction motor drive) and static demand [15].

This article presents the proposed topology like solar and wind, then simulation and results were discussed using MATLAB/Simulation. Finally, conclude with the respective outcomes.

## 2. Proposed Topology

The photovoltaic has created the electron-hole pair, and the electron will flow to the semiconductor material. The electron flow will induce the current in the circuit in the wind the mechanical energy is produced [4]. The power of the wind is

$$P = 0.5\rho A C_p(\lambda, \beta) V^3 \quad (1)$$

The single diode PV model is shown in Figure 1. The wind model is shown in Figure 2.

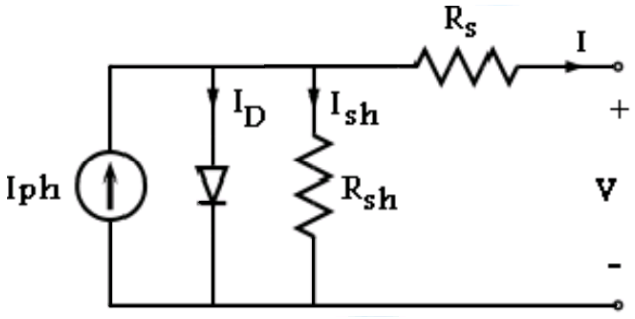


**Figure 1:** Single diode PV model

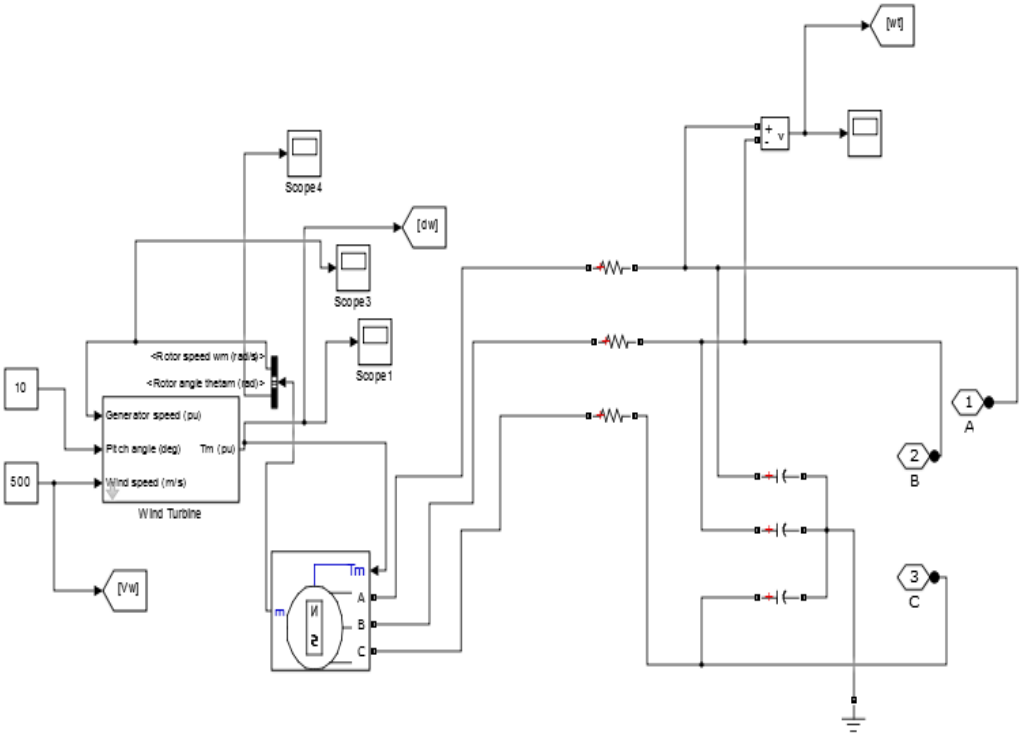


Figure 2: Wind model

The proposed dual input renewable energy is connected to the Z source inverter for producing the power compared to the conventional hybrid connected converter system [3]. The various modes of operation using the switch are connected in series with the solar and wind energy supply. The block diagram of the proposed method is shown in Figure 3.

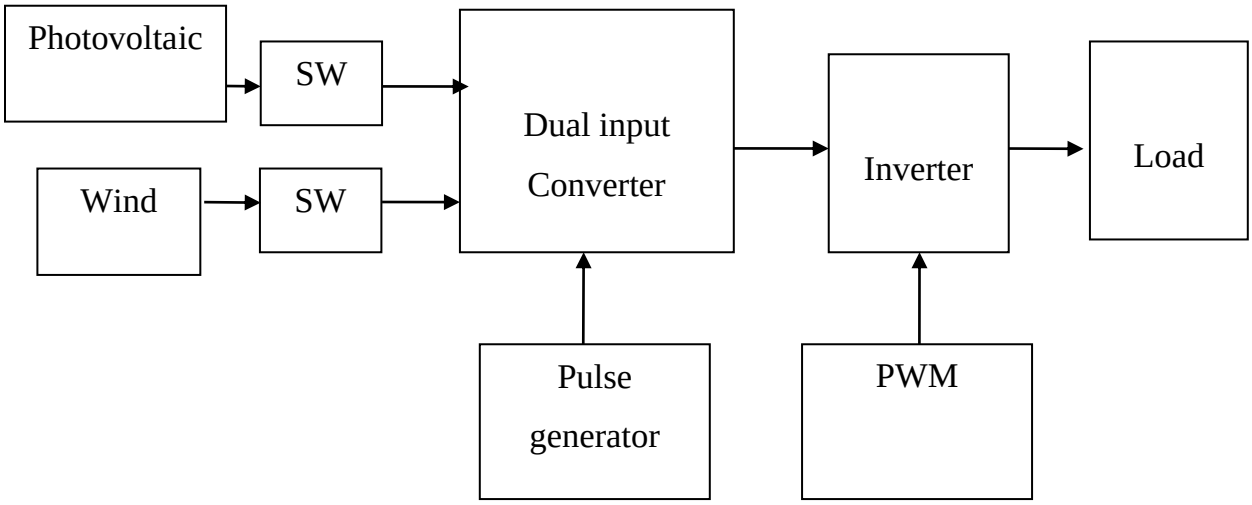


**Figure 3:** Block diagram of the proposed method

In mode 1, the solar and wind is supplied the power to the converter, and the mode 2, the solar is on, and the wind is not connected to the proposed converter [5]. In mode 3, the wind is on, and solar is disconnected from the converter. In mode 4, both the supplied is disconnected to the converter. The diode provides the power to the converter for producing high voltage.

## 3. Simulation Results

The proposed wind and solar-based Z source inverter is shown in Figure4. The Proposed solar and wind-based Z source inverter is implemented using MATLAB/Simulink tool.The sources can be connected to the Z-source inverter, which is designed by MOSFET switch.Whereas the switch is connected in series with the solar and wind energy suppliers to accommodate the multiple modes of operation. The switch can be controlled by Pulse Width Modulation (PWM). Finally the inverter can provide the supply to the AC loads.

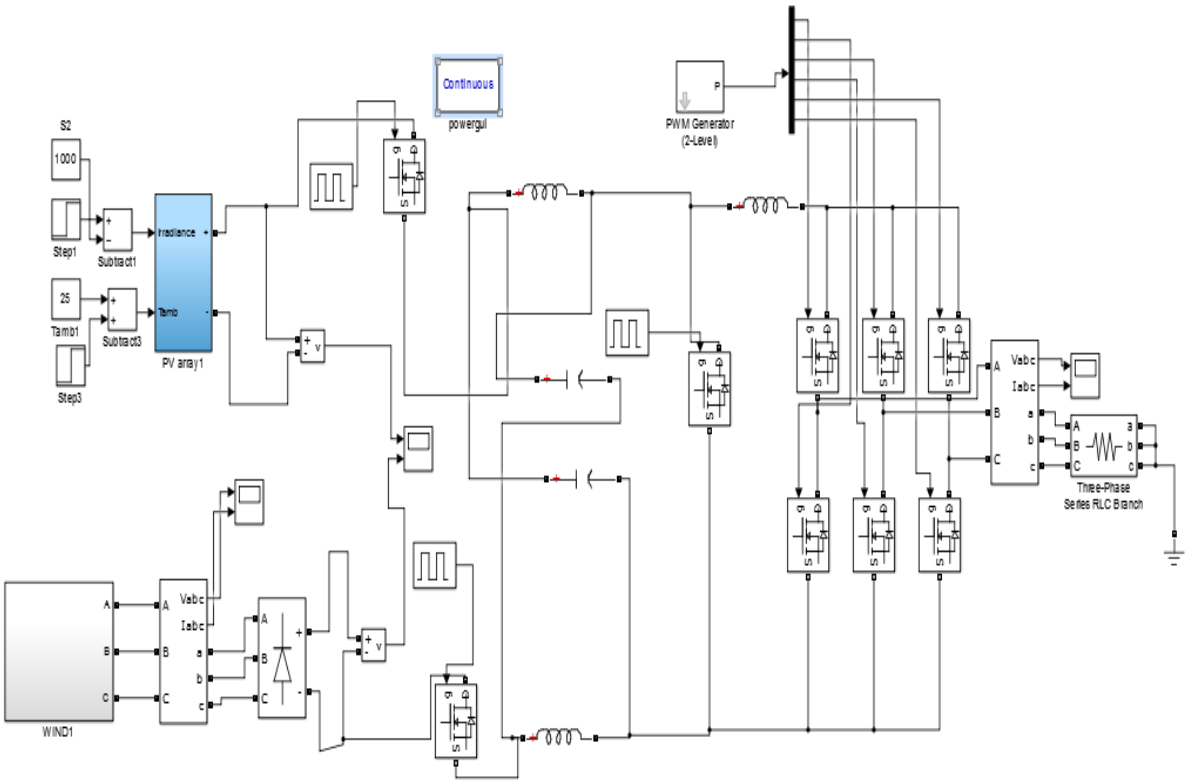


**Figure 4:** Proposed solar and wind-based Z source inverter

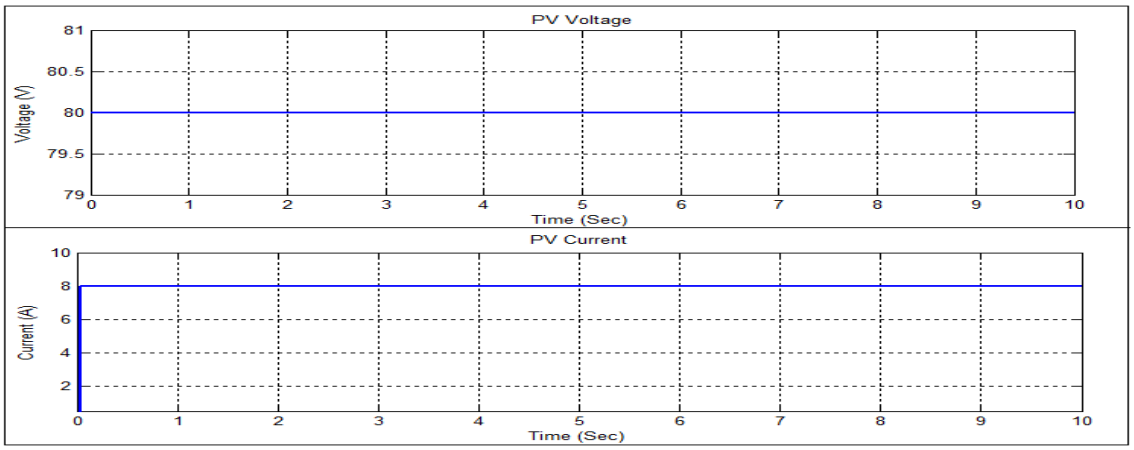


**Figure 5:** PV voltage and current waveform

The PV voltage is shown in Figure 5. Whereas, the PV's output voltage and current is 80V and 8A respectively. This solar PV power is produces from the constant irradiance is 1000 and the temperature is 25°c.

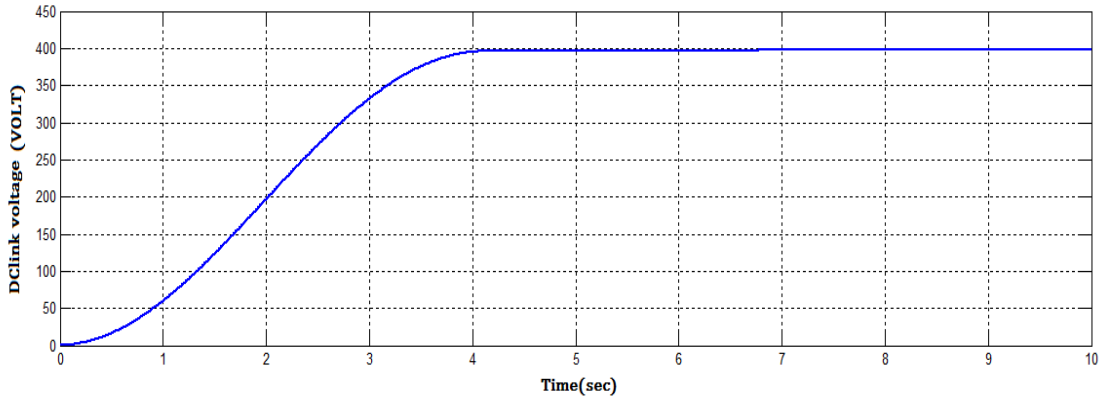


**Figure 6:** DC link voltage across the inverter

The dc-link voltage is shown in Figure 6. Then the DC Link Capacitor is connected across the inverter, which provides the supply to the load is 400V. Initially the supply is zero, then gradually increasing the Dc link voltage. It reach 400V at 4sec.

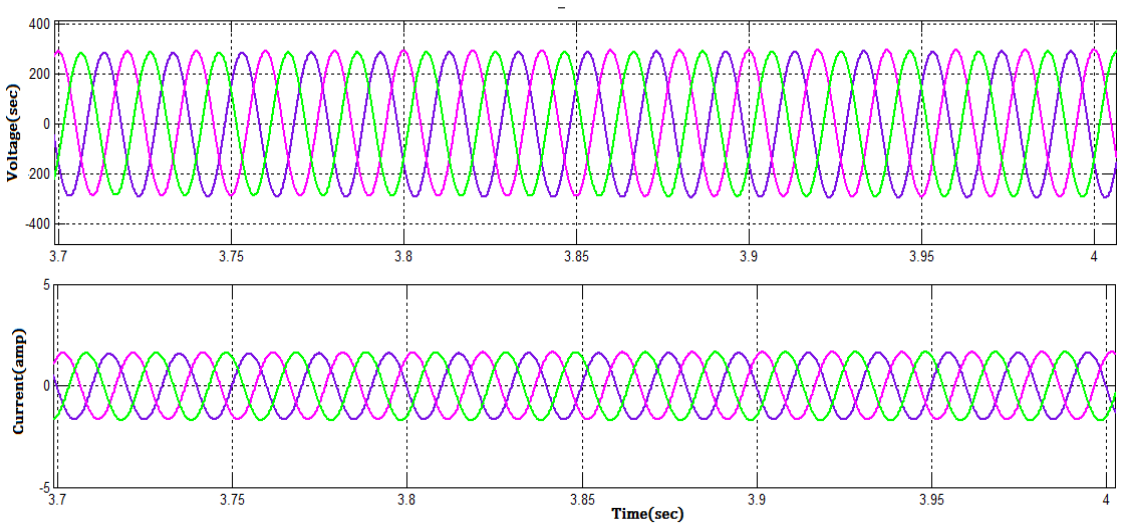


**Figure 7:** Voltage and current waveform of Z source inverter

The inverter output voltage and the current waveform are shown in Figure 7. Then the proposed Z-source inverter can be used to gain the output voltage, which is gained voltage from 80 V DC to 230 V and the current is from 8A to 2A. Finally the proposed Z source inverter provides high output voltage gain.

## 4. Conclusion

The proposed inverter-based renewable energy produced more power and has a continuous supply of converters when both the supply is disconnected to the inverter. The capacitor is charged when the supply is connected to the supply. The capacitor is used to supply the power to the inverter when the supply is disconnected. Hence, Compared to the standard hybrid linked converter system, the suggested dual input renewable energy is connected to the Z source inverter for power production. The presented sources like wind and solar combined power are given to the z source inverter for high power using a dc-dc converter. The switch is connected in series with the solar and wind energy suppliers to accommodate the multiple modes of operation. Finally, the output power is measured through the designed system using the MATLAB/Simulation tool.Thus, the dual input-based Z source inverter produces high output gain, and the results are verified.

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