Designing of 100kv Grid Power using Hybrid Parameters

Vikas Kumar Sungaria[1] Yogesh Tiwari[2]
[1]Research Scholar [2]Associate Professor
[1,2]Department of Electrical and Electronics Engineering
[1,2]Shri Shankaracharya Group of Institutions, Junwani, Bhilai, C.G., India

Abstract— Many multilevel inverter topologies have been proposed during the last three decades. Modern research has engaged novel inverter topologies and unique modulation schemes. Three different major multilevel inverter structures have been reported in the literature: cascaded H-bridges inverter with separate DC sources, diode clamped (neutral clamped) and flying capacitors (capacitor clamped). Multilevel inverters are utilized generally in the regular applications due to the high voltage capacity and it delivers the multilevel with low composition with least concern in the exchanging gadgets. Contrasted with the traditional single scaffold inverter the multilevel inverter lessens the music due to the multi exchanging. The multilevel inverter produces distinctive voltage levels by shifting the exchanging grouping of the inverter. As the conservative energy sources are demolishing, in the middle of consequent mount in cost, solar and wind energy offers a major substitute resource which is free from pollution also. This paper proposes an idea of using hybrid energy system with the multilevel inverter system.

Keywords: DC/DC Boost Converter, Nine Level Inverter, Multilevel Inverter, Hybrid System

I. INTRODUCTION

In many rural areas uninterrupted electricity is not accessible from grid. Mostly the grid gets power from the hydro power station and from thermal power station too. As the conservative energy sources are demolishing, in the middle of consequent mount in cost, solar and wind energy offers a major substitute resource which is free from pollution also. The renewable energy resources are very profitable and they will not cause any detrimental effects on the surroundings. With the latest researches, results the expenditure of photovoltaic cells are likely to go down in future. Each cell having 0.7V and that are allied in series or parallel and form solar array. The PV power generation is a budding modern trend owing to its various advantages resembling inexpensive, ecological responsive power generation.

This work manages the multilevel converters control procedure for photovoltaic framework coordinated in dispersion matrices. The proposed control plan guarantees the infusion of the produced power in the conveyance network with quick element reaction, while giving an extra dynamic force sifting ability giving the required consonant and responsive streams to be considered. The control plan is approved by method for reenactments with a course converter which interfaces to a dispersion network. Additionally, for DC join voltage control, it is required that balances out the voltage at the inverter data to protect a ceaseless stream of vitality trade between the matrix and the PV framework. Similarly, a LC channel is important to channel the yield current and voltage from the sounds and to shield the network from their ruinous impact. At long last, this work presents demonstration of the framework joined photovoltaic era framework parts, in Simulink/Mat lab programming. The results displayed to approve the parts models and the picked control plans.

II. METHODOLOGY

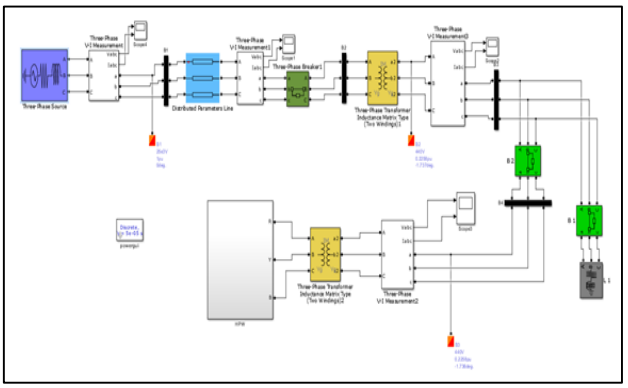

Fig. 2.1: Simulink model of grid connection with hybrid nine level inverter system

A. Hybrid System:

Hybrid energy system is the combination of two energy sources for giving power to the load. In other word it can defined as "Energy system which is fabricated or designed to extract power by using two energy sources is called as the hybrid energy system." Hybrid energy system has good reliability, efficiency, less emission, and lower cost. In this proposed system solar and wind power is used for generating power. Solar and wind has good advantages than other than any other non-conventional energy sources. Both the energy sources have greater availability in all areas. It needs lower cost. There is no need to find special location to install this system.

1) 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 junction formed by semiconductor material. When the junction absorbs light, the energy of absorbed photon is transferred to the electron proton system of the material, creating charge carriers that are separated at the junction. The charge carriers in the junction region create a potential gradient, get accelerated under the electric field, and circulate as current through an external circuit. Solar array or panel is a group of a several modules electrically connected in series parallel combination to generate the required current and voltage. Solar panels are the medium to convert solar power into the electrical power.

2) Wind Turbine:

Wind turbine is that system which extracts energy from wind by rotation of the blades of the wind turbine. Basically wind turbine has two types one is vertical and another is horizontal. As the wind speed increases power generation is also increases. The power generated from wind is not continuous its fluctuating. For obtain the non-fluctuating power we have to store in battery and then provide it to the load.

Charge controller: Charge controller has basic function is that it control the source which is to be active or inactive. It simultaneously charge battery and also gives power to the load. The controller has over-charge protection, short-circuit protection, pole confusion protection and automatic dump load function. It also the function is that it should vary the power as per the load demand. It add the both the power so that the load demand can fulfill. And when power is not generating it should extract power from battery and give it to the load.

3) Battery Bank:

We have to choose battery bank size per the load requirement so that it should fulfill the requirement of load for calculating the battery bank size we need to find following data 1. Find total daily use in watt-hour (Wh). 2. Find total back up time of the battery for increase in battery bank size we need to connect cell in series so that we can get the larger battery bank size.

4) Inverter:

We have to choose greater rating inverter than the desired rating .The pure sign wave inverter is recommended in other to prolong the lifespan of the inverter. Inverter is need to convert DC power into AC power. As our load working on the AC supply so we need to convert DC power. The input voltage Output voltage and frequency, and overall power handling depends on the design of the specific device or the circuitry. The inverter does not produce any power. The power is provided by the DC source.

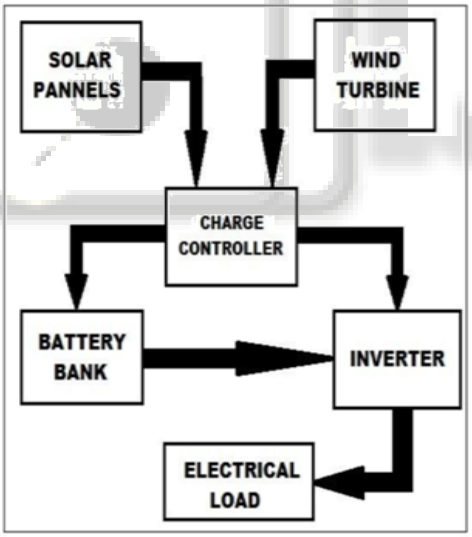

Fig. 2.2: Block diagram of Hybrid energy generation system

B. Multilevel Inverter:

Multilevel inverters are significantly different from the ordinary inverter where only two levels are generated. The semiconductor devices are not connected in series to for one single high-voltage switch. In which each group of devices contribute to a step in the output voltage waveform. The steps are increased to obtain an almost sinusoidal waveform. The number of switches involved is increased for every level increment. The term multilevel began with the three-level converter. Subsequently, several multilevel converter topologies have been developed. However, the elementary concept of a multilevel converter to achieve higher power is to use a series of power semiconductor switches with several lower voltage dc sources to perform the power conversion by synthesizing a staircase voltage waveform. Capacitors, batteries, and renewable energy voltage sources can be used as the multiple dc voltage sources. The commutation of the power switches aggregate these multiple dc sources in order to achieve high voltage at the output; however, the rated voltage of the power semiconductor switches depends only upon the rating of the dc voltage sources to which they are connected.

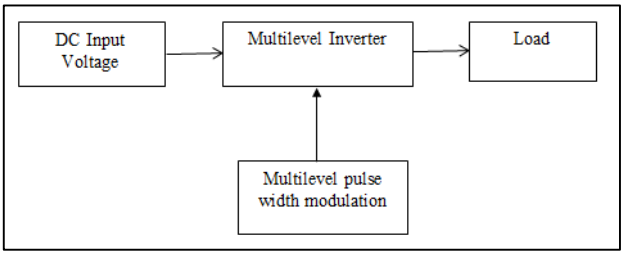

Fig. 2.2: Block diagram of the general multilevel inverter

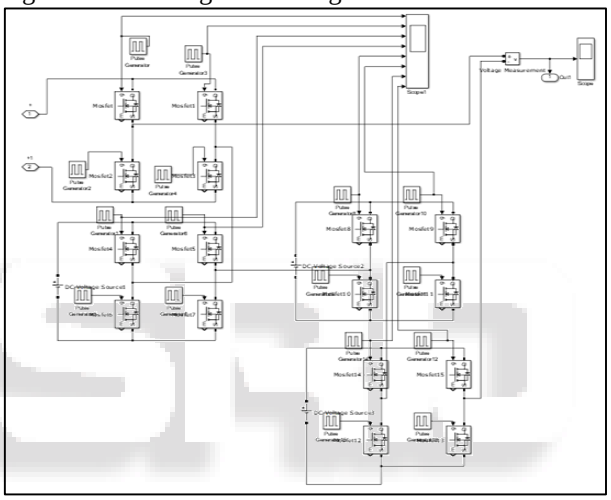

Fig. 2.2: Nine level inverter

1) Pulse width modulation (PWM):

Pulse width modulation (PWM) or pulse-duration modulation (PDM), is a method of reducing the average power delivered by an electrical signal, by effectively chopping it up into discrete parts. The average value of voltage (and current) fed to the load is controlled by turning the switch between supply and load on and off at a fast rate. The longer the switch is on compared to the off periods, the higher the total power supplied to the load. Along with MPPT maximum power point tracking, it is one of the primary methods of reducing the output of solar panels to that which can be utilized by a battery.[1] PWM is particularly suited for running inertial loads such as motors, which are not as easily affected by this discrete switching. Because they have inertia they react slower. The PWM switching frequency has to be high enough not to affect the load, which is to say that the resultant waveform perceived by the load must be as smooth as possible.

III. RESULT

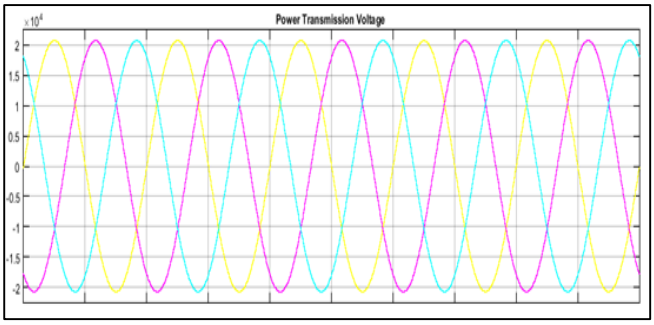

Fig. 3.1: Three phase source Voltage (V) vs Time (sec) plot

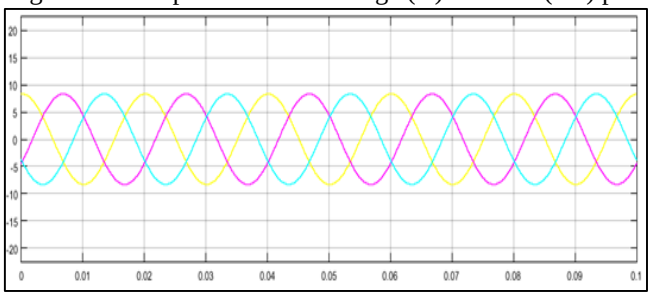

Fig. 3.2: Three phase source Current (Amp) vs Time (sec) plot

The figures 3.1 and 3.2 show the three phase grid supply voltage and current respectively fed to the system.

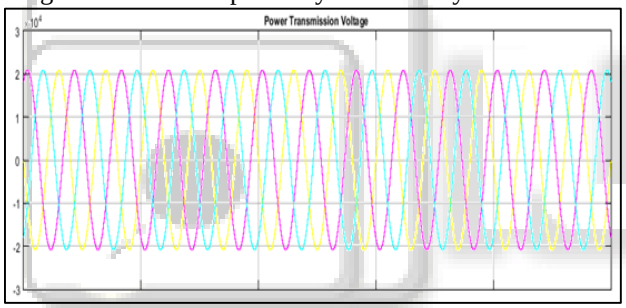

Fig. 3.3: Three phase distributed line Voltage (V) vs Time (Sec) plot

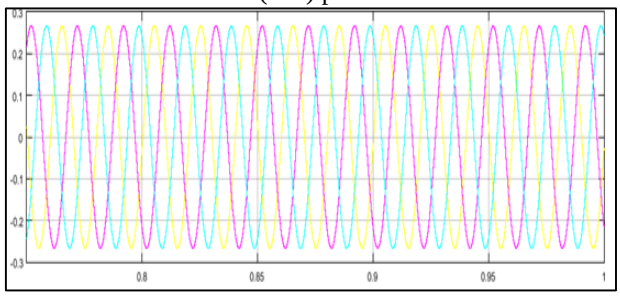

Fig. 3.4: Three phase distributed line Current (A) vs Time (Sec) plot

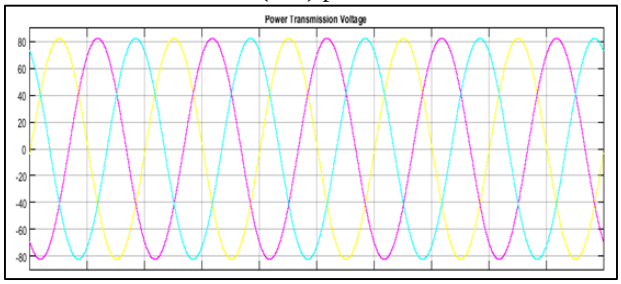

Fig. 3.5: Three phase step down transformer output Voltage (mV) vs Time (sec) plot

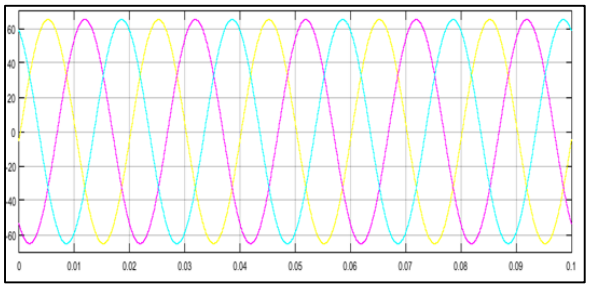

Fig. 3.6: Three phase step down transformer output Current (mA) vs Time (sec) plot

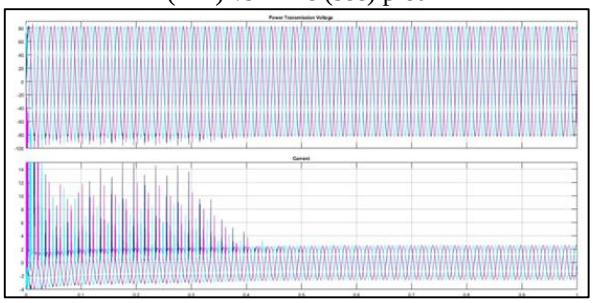

Fig. 3.7: Nine level inverter output Voltage (V) and Current (A) vs Time (sec) plot

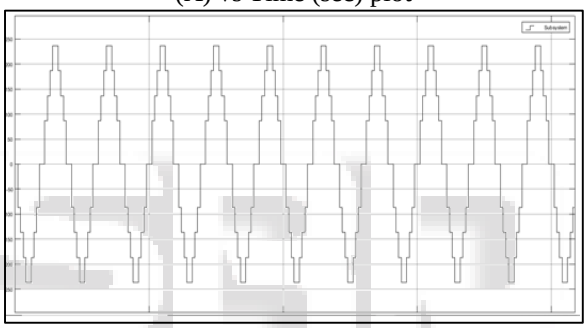

Fig. 3.8: 9 level inverter output

IV. CONCLUSION

Hybrid power generation system is good and effective solution for power generation than conventional energy resources. It has greater efficiency. It can provide to remote places where government is unable to reach. So that the power can be utilize where it generated so that it will reduce the transmission losses and cost. Cost reduction can be done by increasing the production of the equipment. People should motivate to use the non-conventional energy resources. It is highly safe for the environment as it doesn't produce any emission and harmful waste product like conventional energy resources. It is cost effective solution for generation. It only need initial investment. It has also long life span. Overall it is good, reliable and affordable solution for electricity generation.

V. FUTURE SCOPE

Multilevel inverters are finding increased application in industrial environment with greater demand for high voltage high power processing techniques with improved efficiency. The essential advantage of multilevel inverters is the improvement in the output voltage signal quality using devices of low voltage rating with lesser switching frequency, thereby increasing the overall efficiency of the system.

Multilevel inverters can be applied to utility interface systems and motor drives. These converters offer a low output voltage THD, and a high efficiency. A multilevel inverter can reduce the harmonics produced by the inverter and better THD is obtained when the inverter operated at higher modulation index.

REFERENCES

[1] Alphy Elizabeth Joseph, Joffie Jacob, A HYBRID CASCADED NINE LEVEL INVERTER, ISSN (PRINT): 2393-8374, (ONLINE): 2394-0697, VOLUME-2, ISSUE-10, 2015, INTERNATIONAL JOURNAL OF CURRENT ENGINEERING AND SCIENTIFIC RESEARCH (IJCESR)
[2] Anees Abu Sneineh, Ming-yan Wang, Novel Hybrid Flying-Capacitor-Half-Bridge 9-Level Inverter , Harbin Institute of Technology/School of Electrical Engineering and Automation, Habin, China, 2017
[3] Bahman, Amir Sajjad; Blaabjerg, Frede, Comparison between 9-level hybrid asymmetric and conventional multi-level inverters for medium voltage application, Proceedings of the 2013 IEEE International Symposium on Industrial Electronics (ISIE)
[4] Indrajit Sarkar and B. G. Fernandes, 9-level Hybrid Symmetric Cascaded Multilevel Converter for Induction Motor Drive, Department of Electrical Engineering, Indian Institute of Technology Bombay
[5] K.Durga Prasad,G.Venkateswarao, Multi-Level Inverter with Facts Capability for Reliable Power Distributions Using Wind Energy as Source, International Journal of Science Engineering and Advance Technology, IJSEAT, Vol 3, Issue10, OCTOBER-2015
[6] K.Srinivasulu , B.Manthru Naik, Solar Power Generation Seven Level To Nine Level Inverter, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering , Vol. 5, Issue 12, December 2016
[7] Kaliamoorthy M, Member, IEEE, Rajasekaran V, Member, IEEE, PraveenRaj G, Member, IEEE, A Novel Single Phase Cascaded Multilevel Inverter for Hybrid Renewable Energy Sources, 2015 INTERNATIONAL CONFERENCE ON ADVANCED COMPUTING AND COMMUNICATION SYSTEMS (ICACCS-2015), JAN 05-07,2015,COIMBATORE,INDIA
[8] MOHD FAIZAL BIN MUSTAPHA, ELIMINATION THD USING 9- LEVEL DC TO AC CASCADE H-BRIDGE MULTILEVEL INVERTER, Universiti Tun Hussien Onn Malaysia, 2013
[9] Mohamad N. Abdul Kadir†, Saad Mekhilef∗, and Hew Wooi Ping, Dual Vector Control Strategy for a Three-Stage Hybrid Cascaded Multilevel Inverter, Univ. of Malaya ∗Dept. of Electrical Engineering, University of Malaya, Malaysia, 2010
[10] Nunsavath Susheela*, P. Satish Kumar, Performance Evaluation of Multicarrier Based Techniques for Single Phase Hybrid Multilevel Inverter using Reduced Switches, Indonesian Journal of Electrical Engineering and Computer Science Vol. 7, No. 3, September 2017, pp. 676 ~ 686 DOI: 10.11591/ijeecs.v7.i3.pp676-686.
[11] Saad Mekhilef, Member, IEEE, and Mohamad N. Abdul Kadir, Novel Vector Control Method for Three-Stage Hybrid Cascaded Multilevel Inverter, IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 58, NO. 4, APRIL2011
[12] Alphy Elizabeth Joseph, Joffie Jacob, "A HYBRID CASCADED NINE LEVEL INVERTER" ISSN (PRINT): 2393-8374, (ONLINE): 2394-0697, VOLUME-2, ISSUE-10, 2015.
[13] K.Srinivasulu, B.ManthruNaik, "Solar Power Generation Seven Level To Nine Level Inverter", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, Vol. 5, Issue 12, December 2016.
[14] Mekhilef, Member, IEEE, and Mohamad N. Abdul Kadir, "Novel Vector Control Method for Three-Stage Hybrid Cascaded Multilevel Inverter", IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 58, NO. 4, APRIL 2011 1339.
[15] NunsavathSusheel, P. Satish Kumar, "Performance Evaluation of Multicarrier Based Techniques for Single Phase Hybrid Multilevel Inverter using Reduced Switches", Indonesian Journal of Electrical Engineering and Computer Science Vol. 7, No. 3, September 2017, pp. 676 ~ 686.

