EFFICIENT AND RECONFIGURABLE SMART HOME INVERTER DESIGN TOPOLOGY WITH SOLAR ENABLED HYBRID POWER SCHEME FOR AC/DC COMPONENTS

[1] I. RAHUL [2] MOHAMMED MAJID

[1]Assistant Professor, Department of EEE, Holy Mary Institute of Technology& Science, Hyderabad, TS, India
[2]Pg Scholar, Department of EEE (EPS), Holy Mary Institute of Technology& Science, Hyderabad, TS, India.

ABSTRACT

In future generation is depends just on sustainable power source. Now a day's pollution is a major drawback for the environment. So it is necessary to obtain energy in an eco-friendly manner. By methods for sun oriented and Wind source we can acquire most extreme yield as both air conditioning and DC dependent on the possibility of this paper. By virtue of utilizing the reconfigurable inverter application on this thought we can lessen misfortunes for utilizing converter. By the utilization of DC generator in wind vitality extraction it is leverage of disposing of the converter or rectifier in this paper. Both sun oriented and wind controlled framework is at first attempted in the MATLAB then we can think about the yield. On the off chance that the yield of the CRO and Simulink display are come same. The DMPPT assumes a noteworthy job of acquiring greatest yield. The arduino miniaturized scale controller is utilized get a consistent yield how which methods for steady power age CPG. Finally we can got air conditioning and furthermore including DC yield to the framework. The reasonable power source is most required one for current century and for future. By well ordered the utilization of imperativeness

Key words: solar Photo Voltaic, crossed AC/DC house applicants, harmonic disturbance elimination

1. INTRODUCTION

The renewable energy is most needed one for current century and for future. By day by day the usage of energy goes higher especially all the renewable energies. So the production and capacity also get increases. The sunlight based PVs development rate have included more power limit among all the sustainable power sources from 2009 to 2013. The rooftop top sun oriented PV will acquire prevalence in system of dispersion by methods for decrease cost of sun based boards, likely the government strategies offers installment to empower sustainable power source utilization, measured quality and furthermore less upkeep and so forth. Yet, between of the idea of the inexhaustible steady steadiness and confident issues in the circulation framework. To diminish the unconventionality in the sun based PV generation, stockpiling choice are empowered, for example, battery framework, Fuel cells. In view of enhancing the nonlinear present day lodging hardware and current innovation in the home, it requires to grow the profitability and solace, are primary crude material for producing the symphonious current in feeder also, generally influencing the power quality, the loss of intensity including a noteworthy downside for electrical engineers. The new current family unit loads give a more noteworthy points of interest. The new decrease of issue in the conveyance framework. The DC smaller scale lattice give a more noteworthy an utilization in the downside to finish the DC gr id. By the investigation of based of 2050 are quickly expanded. Presently multi day both AC and DC loads are for the most part required.

Frequently going lattice associated inverter takes more DC voltage which will be the pinnacle greatness of the L-L framework voltage. Particularly it needs two phase of transformation process for DC voltage boosting and furthermore to rearrange it. In view of this cost, measure, loss of the framework gets expanded. With the end goal to evacuate this reconfigurable inverter topology is actualized. In this reconfigurable inverter topology, inverter without transformer increased extraordinary inquire about enthusiasm as clarified in ref. [10]. Inverter without transformer will give low size and cost by wiping out the transformer. Because of the sunlight based board is halted by its discontinuity parts of things and in this manner stockpiling of vitality by methods for battery might be required to give the power at the purpose of not having required sun oriented radiation. On account of having a converter or rectifier for battery increment will the expense and size of the converter too. To conquer this reconfigurable sun oriented inverter is executed in refs 9 to the use of PV framework incorporating with battery stockpiling. This reconfigurable topology is better adjusted for both breeze cultivate furthermore, sun oriented applications. In the wake of testing the new calculation in this way result will be checked. Fundamentally while utilizing the sun powered, battery is utilized to give proficient power supply. In this manner while utilizing AC generator will require to evade this DC generator is utilized.

3.WORKING PRINCIPLE

The aim of this paper is to introduce reconfigurable inverter by means of solar and wind energy to get hybrid AC and DC hybrid output for household applicants with help of energy storage devices. The main process in the basic concept of the reconfigurable inverter to implement a power conversion system to work on various modes of operation such as PV and wind connected to the grid, PV and wind which has been connected to battery and at last grid to battery. Thus this inverter network is checked to get both DC and AC hybrid output for the household applicants. There will not get much hormonic disturbance in the system.

4. TOPOLOGY OF RECONFIGURABLE SOLAR CONVERTER (RSC)

The reconfigurable inverter get DC input and to get the output as both AC and DC hybrid output. The circuit diagram of reconfigurable inverter is given in the Fig. 1.The main advantages of reconfigurable is that minimize the usage of mechanical switches. The various modes of operation has been mentioned in figs.2-5.

4.1Mode-1

In the first mode of operation PV and wind hybrid input is directly connected to the grid is shown in fig 1. At that point by means of DMPPT distributed maximum power point network we can obtain maximum output .By the usage of MPPT we should extract maximum output.

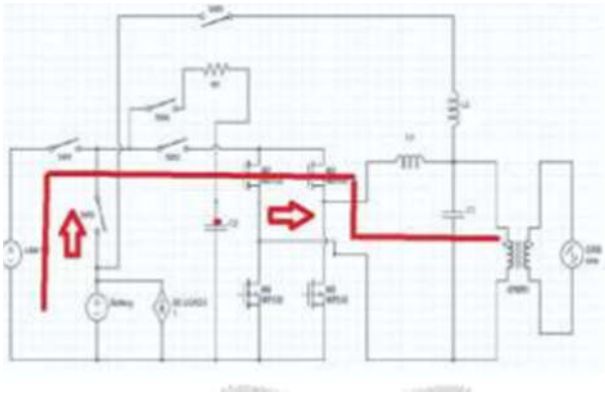

Fig. 1. PV to Grid

4.2 Mode-2

In Fig. 2, the second mode of operation is to supplying power to the network of grid from both solar PV hybrid wind to the battery. If any power shortage occurs due to climatic condition

we can go with the grid supply to entire network.

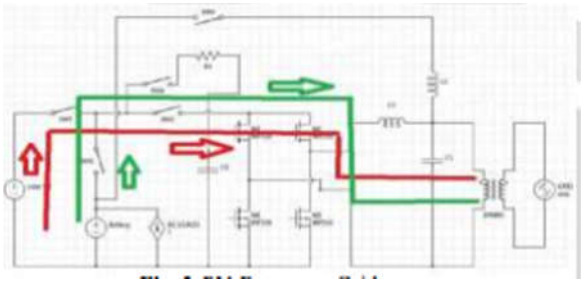

Fig. 2. PV-Battery to Grid

4.3 Mode-3

In this mode battery has been connected to grid system. This mode is operated at time of input beyond the required level.

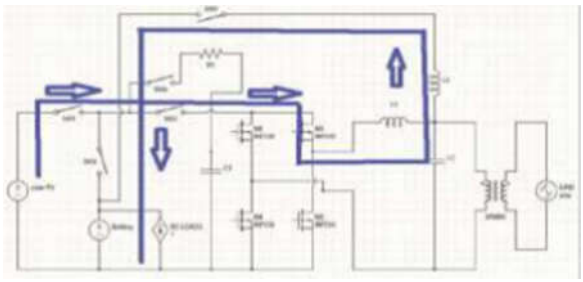

Fig. 3. PV-Battery to Grid

4.4 Mode-4

From Fig. 4, this mode of operation provide a final supply to network of the system. At this mode MPPT plays a major role.

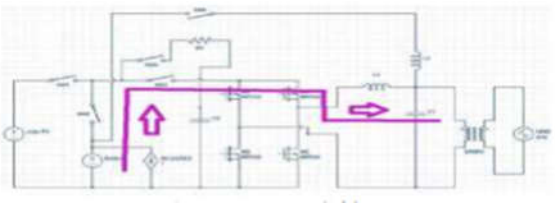

Fig. 4. Battery to Grid

5. CONTROL OF THE PROPOSED CONVERTER

For controlling this proposed single phase inverter, PQ controller is used considering the advantage that it will control the active and reactive power according to the reference signal. Since the controlling elements for the AC system are very difficult due to their time varying nature, the AC control variables are converted to a stationary reference frame from a rotating reference frame for effective control.

Let $F\alpha$ & $F\beta$ be the rotating reference frame variables which can be voltage or current, whereas Fd & Fq be the stationary variables. In rotatory reference frame the active and reactive powers can be calculated by using (1) and (2).

$$P = \frac{1}{2}[v_d * i_d + v_q * i_q]$$
$$Q = \frac{1}{2}[v_d * i_q - v_q * i_d]$$

where, v & i are the instantaneous values of voltage and current, respectively. When the inverter is synchronized to the grid the value of vq becomes zero

$$P = \frac{1}{2}[v_d * i_d]$$
$$Q = \frac{1}{2}[v_d * i_q]$$

The active and reactive reference currents are given as,

$$\widehat{i_d} = \frac{2 * \hat{P}}{v_d}$$
$$\widehat{i_q} = \frac{2 * \hat{Q}}{v_d}$$

where, $\hat{P}$ & $\hat{Q}$ are the reference power signals of active and reactive power.

Calculated values of $id\hat{}$ & $iq\hat{}$ are converted into stationary reference frame and given as signal to PQ controller to produce reference signals for the Sinusoidal Pulse Width Modulation (SPWM) controller. Synchronizing the solar inverter with grid requires the knowledge of the magnitude and phase of the grid supply voltage. Phase Lock Loop (PLL) will track the phase of the grid and help to synchronize with the grid.

To obtain maximum power from the solar panel, according to maximum power transfer theorem, the panel resistance should be equal to the load resistance which is connected to this panel. To achieve this, a hill climbing Maximum Power Point Tracking (MPPT) algorithm is used. This technique will equalize the resistances and extract maximum power from the solar panel. The control diagram for different modes of operations of the RSC is given in Fig 5 & 6. In Fig 5, the inverter operation of the RSC is explained. From voltage and current measurement from the solar panel, voltage is set to extract maximum power from the panel using MPPT algorithm.

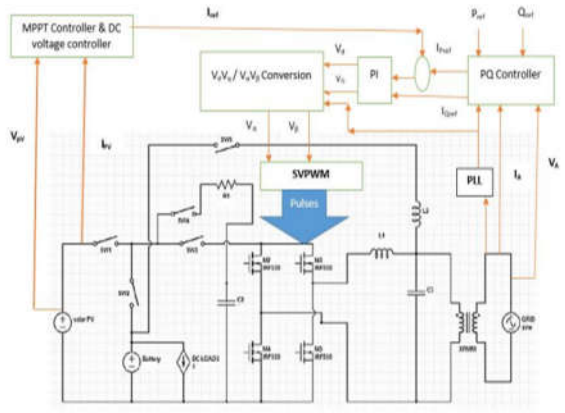

Fig. 5. DC/AC inverter operation

link voltage and error is given to a PI controller for DC link voltage regulation. This PI controller will produce reference current which is compared with reference current produced using PQ controller which is given in (5) and (6). This error is given to a PI controller which will generate reference voltage for active power control. Reactive power is separately controlled using another PI controller. These reference voltages are converted to rotating reference frame voltages and given to space vector PWM to drive the inverter. Battery is charged from solar panel using DC/DC conversion mode of RSC which is given in Fig 6. One of the MOSFET switch is used to obtain required voltage level for the battery. Here constant voltage charging is used. MPPT controller will produce the required current which is given to a PI controller to produce the reference voltage. This voltage is compared with the battery voltage and duty cycle is generated. From this duty cycle PWM pulses are generated which is given to the MOSFET switch. Thus, both AC and DC loads are given supply using a single reconfigurable inverter.

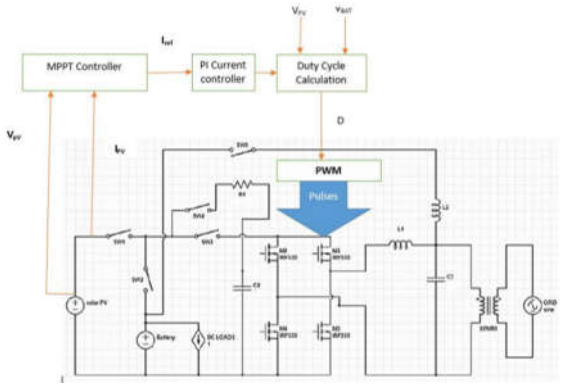

Fig. 6. DC/DC chopper operation

6. RESULTS

Simulation of the proposed converter is done in MATLAB/Simulink. The radiation is kept at maximum at 1000 W/m2 . Inbuilt PLL and PWM pulse generator blocks in MATLAB/Simulink is used for controlling the inverter. The design is done for 500 Watt inverter topology. The active and reactive power output for a load of 320 Watt and 80 VAr is simulated and shown in Fig 7. In order to synchronize the solar inverter with grid, the magnitude and phase of the grid supply voltage must be known. Phase locked loop (PLL) is system which will track a signal with other signal system. PLL is actually a servo mechanism which will reduce the difference between phase and frequency of incoming signal to a reference signal. Active power transfer to the grid is possible if there is a difference between the Phase of the inverter and the grid supply system. PLL will capture the phase of the

grid supply and required phase shift is generated using inverter controller for power transfer. The phasor diagram of inverter and grid supply during the power transfer is shown in Fig 8.

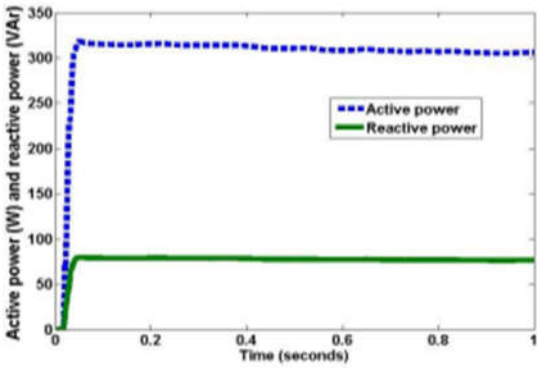

Fig. 7. Active and reactive power generation

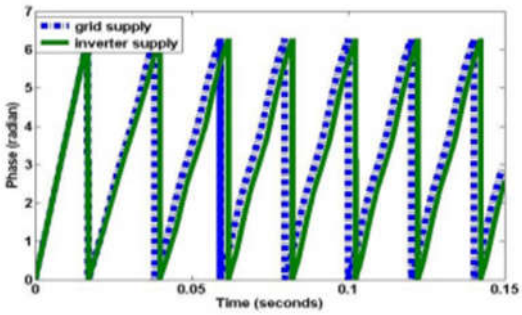

Fig. 8. Phases in radians

Battery charged through the proposed topology. Here constant voltage charging method is followed. Li-ion battery which is an inbuilt block of MATLAB/Simulink is used as battery storage. The output voltage during the charging is given in Fig 9.

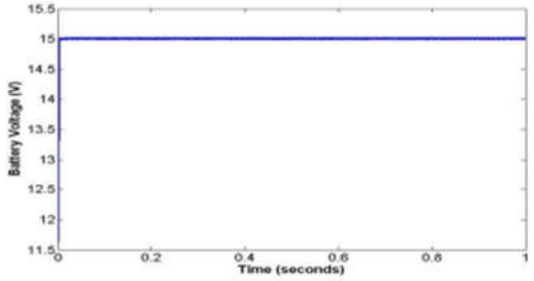

Fig. 9. Battery voltage

CONCLUSION

This paper recommended a more appropriate converter topology for a sunlight based fueled crossover air conditioning/DC home. The principle ideas of this topology is that a solitary stage single change of air conditioning capacity to DC and the other way around is utilized, which enhanced the productivity, diminishes volume and upgrades the unwavering quality. The equipment execution approves that the recommended converter topologies would be useful to diminish huge measure of sounds in the private feeders of things to come Shrewd Network. However, here just sunlight based PV is considered as wellspring of intensity, this topology could be similarly pertinent to wind, power modules and so on.

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AUTHOR’S BIOGRAPHY

[1]**I. RAHUL,** pursuing his Ph.D in Saveetha University, Chennai. He completed his B.Tech. Degree in Electrical and Electronics Engineering from JNTU-Hyderabad, Telangana, India in the year 2008 and M.Tech from JNTU-Hyderabad, India in the year 2012. He has vast teaching experience of nearly 06 years in various engineering colleges. Presently he is working as Assistant Professor in Holy Mary Institute of Technology and Sciences, Bogaram (V), R.R. Dist, Hyderabad, Telangana, India in the Dept. of Electrical and Electronics Engineering. His areas of Interest are Power Electronics and Drivers, Renewable Energies, etc.

[2]**MOHAMMED MAJID** completed his B.Tech. Degree in Electrical and Electronics Engineering from Balaji Vishnu Raju Institute of Technology JNTU-Hyderabad, Narsapur, Telangana, India in the year 2017. **Pursuing M.Tech** in **Electrical Power Systems** in Holy Mary Institute of Technology & Sciences, Bogaram, R.R.District, Hyderabad, Telangana, India. He Interested topics are FACTS, Power Systems Protection, High Voltage Engineering.