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SOLAR POWERED UPS SYSTEMS

[1]Ruturaj Dhamdhere, [2]Rahul Gajare, [3]Himanshu Gaikwad, [4]Shubham Takalkar

[1]UG Scholar, Department of Electrical Engineering. JSPM's Polytechnic, Wagholi, Pune
2UG Scholar, Department of Electrical Engineering. JSPM's Polytechnic, Wagholi, Pune
3UG Scholar, Department of Electrical Engineering. JSPM's Polytechnic, Wagholi, Pune
4UG Scholar, Department of Electrical Engineering. JSPM's Polytechnic, Wagholi, Pune
ruturajdhamdhere9666@gmail.com

Abstract- This paper provides the research and development of a solar powered UPS in India's market as an alternative source of energy. It consists of design which is done according to our research. The design of solar UPS consists of solar charge controller, inverter circuit and a solar panel. During this process many circuit simulation were done to fit the requirement of this project. It also shows that solar Ups can be highly efficient and successful in electrical UPS market. This project consists of solar panel which consist solar cell which convert solar energy into electrical energy. We also have charging circuit which will charge 12V DC (direct current) battery given in fig:-2 and inverter circuit have given in fig:-3 & fig:-5 will convert it AC (alternative current).

Index Terms:- On-grid, Off-Grid, UPS, Solar Charge Controller, Renewable Energy

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I. INTRODUCTION

Solar power in India is a fast developing industry. As of December 2017 the country's solar power had 17.05 GW total capacity. India expanded its solar-generation capacity 8 times from 2,650 MW on 26 May 2014 to over 20 GW as on 31 January 2018.The 20 GW capacity was initially targeted for 2022 but the government achieved the target four years ahead of schedule. The country added 3 GW of solar capacity in 2015-2016 and over 5 GW in 2016-2017, the most noteworthy of any year, with the normal flow cost of sunlight based power dropping to 18% beneath the normal cost of its coal-terminated. In January 2015 the Indian government extended its sun based plans, focusing on US$100 billion in speculation and 100 GW of sun oriented limit (counting 40 GW from housetop sunlight based) by 2022. India's drive of 100 GW of sunlight based energy by 2022 is an aggressive objective, since the world's introduced sun based force limit in 2017 is relied upon to be 303 GW. The enhancements in sun oriented warm stockpiling power innovation as of late has made this assignment reachable as the less expensive sun based force need not rely upon exorbitant and dirtying coal/gas/atomic based force age for guaranteeing stable lattice activity.Most of the rural area still face the problem of electricity which force them to be reliable on kerosene lamp. This major problem can be overcome by usage of solar energy. I have studied the model through which this major problem can be eliminated.

1.1 Advantage of solar power

The main advantage of using solar power energy is it’s a renewable energy and viable for long term, the maximum efficiency of solar power can be attain by proper orientation within right location. The actual beauty of solar powered supply lies in its ability to capture light energy and generate electrical energy, that can be used both as online energy source (on-grid) in case of power failure and also as Independent/alternate energy source (off-grid). There is no pollution in atmosphere due to nitrogen oxide, carbon dioxide or any other pollutants. It is an unlimited source of power which is free, unlike deleterious fossil fuels which are expensive as well.

1.2 Solar UPS solution

India still faces unprecedented energy crisis in rural and suburban area. The problems become more severe during summers. However, winter in no different as there was still an average power outage of 3-4 hours every day. Those without generators and UPS faced tremendous problems in these outages. The prices of both continued to increase due to a sharp increase in their demand. We are not using solar UPS as there replacement but it can be used as backup energy during grid failure. It also does no harm to environment. The sun shines bright throughout the year. Global solar Radiation estimates

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have been made for most parts of the world, and also for major cities of India which is essential for the optimum design of solar energy conversion systems. We can make use of this inexhaustible resource and contribute towards meeting the shortfall of electricity. The global formula to estimate the electricity generated in output of a photovoltaic system is: -

$$E=A*r*H*PR$$

E =Energy (kWh)

A = Total solar panelArea (m2)

r = solar panel yield or efficiency (%)

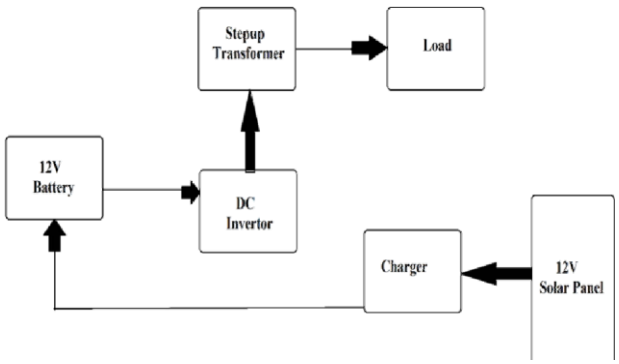
H = Annual average solar radiation on tilted panels (shadings not included)

PR = Performance ratio, coefficient for losses (range between 0.5 and 0.9, default value = 0.75)

II. SYSTEM DESIGN

In this solar based UPS project, we have used solar energy for charging 12V DC battery. Our solar panel will constantly charge battery with the help of solar charge controller given in fig:-2. And once we switch on the circuit the battery charge will inverted into AC with help of inverting circuit and stepped the voltage from 12V DC to 230V AC given in fig:-3 & fig:-5. This system can successfully use as UPS as an emergency power cut and have a capacity to standalone without any external electricity.

2.1 Block diagram:-



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Figure 1 Block diagram of solar UPS.

2.2 Solar charge controller:-

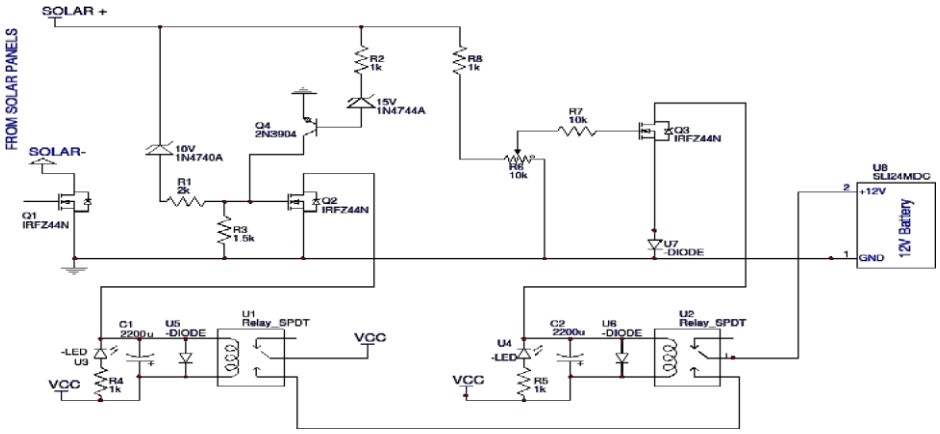


Figure 2 solar charge controller.

III. INVERTER CIRCUIT DIAGRAM

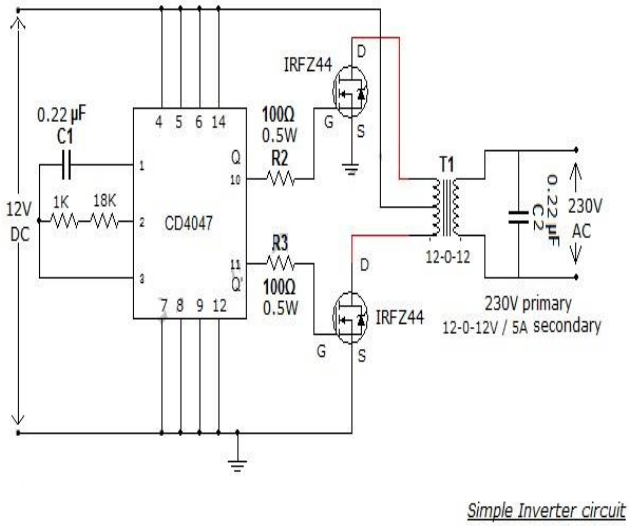


Figure 3 simple inverter circuit diagram

AC can't be stored for future use but DC can be stored for future use in a battery. The stored DC can be converted back to AC by using power inverters.

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Working of DC to AC Inverter

- Solar charge controller is used to charge 12V DC battery.
- The inverter is built with the help of IC CD4047 which is wired as astable multivibrator.
- The operating frequency of astable multivibrator is set to 50Hz.
- The MOSFETs IRFZ44 are directly driven by the Q and Q' output of CD4047.
- The MOSFETs are connected in Push Pull configuration (Power amplifier). The MOSFETs will switch according to the pulse from CD4047 astable multivibrator.
- Thus an AC voltage from output is transferred to the primary of transformer; it is stepped up to 230V.
- The transformer used here is an ordinary step down transformer which is connected in inverted manner. That is, the primary of a 230V to 12V-0-12V step down transformer can be treated as secondary for this Solar ups project.
- If you would like to get 110V AC, choose 110V to 12V-0-12V step down transformer in reversed way.
- The inverter output is filtered by capacitor C2.
- Use suitable heat sinks for MOSFETs.

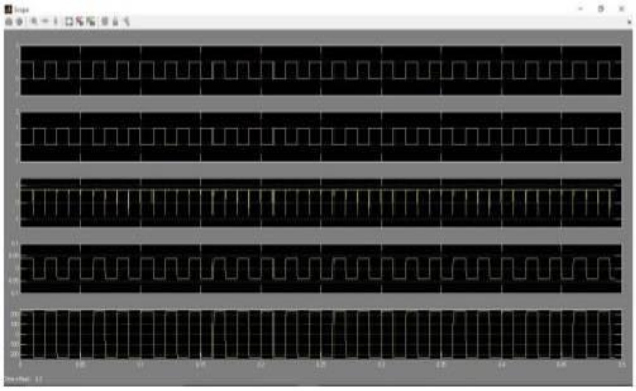


Figure X: Scope Displayed Wave Forms

Fig. 4 square wave

3.1 Solar inverter advantage

After knowing in detail what a solar inverter is and how different useful it is to make appliances work at residential and industrial levels we must discuss about the many advantages of the device.

- Solar energy is a renewable energy which helps in reducing global warming and greenhouse effect.

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- Solar energy helps in saving money as many people have started using solar based devices.
- A solar inverter is really convenient for those people who use limited amount of energy.
- There is this synchronous solar inverter which helps both small homeowners and power companies as they are large in size
- There is this multifunction solar inverter which is the best among all and works efficiently. It converts the DC power to AC very carefully which is perfect for commercial establishments
- This inverter is effective in cost i.e. less expensive than generators
- Apart from solar inverters there are other devices too that make use of solar energy namely, solar cooker, solar heater.
- Solar inverters are way better than normal electric ones. Also their maintenance does not cost much money

3.2 Solar inverter disadvantage

- Initially you need good amount of money for buying a solar inverter.
- Its efficiency is totally dependent on amount of strong sunlight.
- The solar panels that are used to attract Sunlight requires lots of space as it depend on amount of sunlight.
- Solar Inverters can work at no sun but it require fully charged battery.

IV. EXPERIMANTAL RESULTS

As a whole world is facing problem of global warming and energy crisis, our project will help to reduce these problem by using solar energy to generate electricity. Solar energy is an infinite source of energy. Main Moto of our project is to promote use of renewable energy source. This project is most useful in our life because in this project one time investment fixed on life time.

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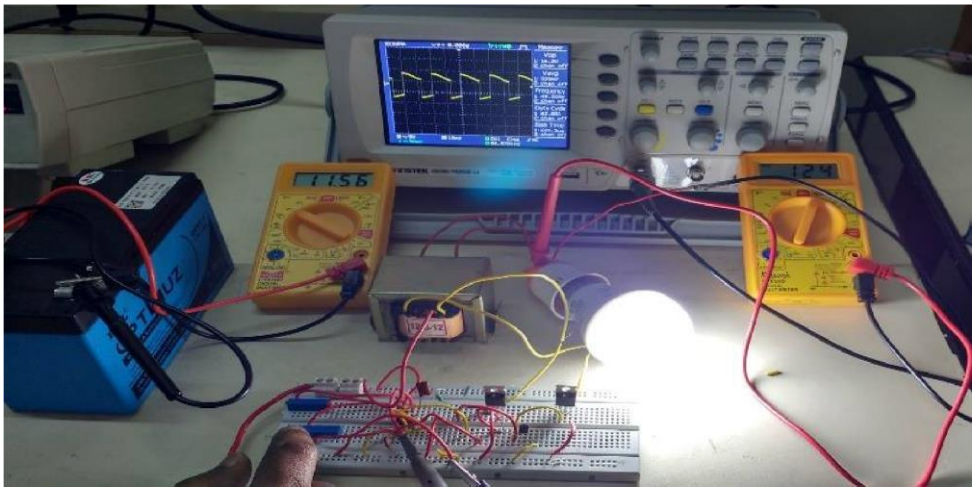


Figure 5: - Inverter in bread board.

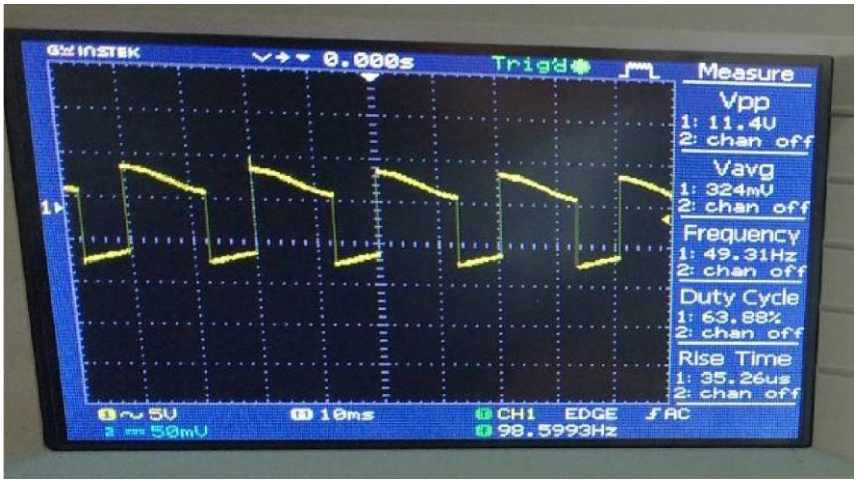


Figure 6:-Square wave in oscilloscope.

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Figure 7:-final solar based UPS.

V. CONCLUSION

Photovoltaic power production is gaining more significance as a renewable energy source due to its many advantages. These advantages include everlasting pollution free energy production scheme, ease of maintenance, and direct sunbeam to electricity conversion. However the high cost of PV installation still forms an obstacles for this technology. Moreover the PV panel output power fluctuates as weather conditions, such as the isolation level, and cell temperature. The describe design of the system will produce the desired output of the project. The inverter given in fig:-3 & fig:-5 will supply an AC source from a DC source.

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