e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:01/January-2023 Impact Factor- 6.752 www.irjmets.com

REVIEW OF SMART HYBRID INVERTER FOR BATTERY CHARGING

Akshay Meshram[*1], Lalit Bhagat[*2], Mahima Bawane[*3], Shital Yende[*4], Rahul Dekate[*5], Priyanka Gaurkhede[*6]

[*1,2,3]UG Students, Department Of Electrical Engineering, S.C.E.T., Vihirgaon, Nagpur, Maharashtra, India.

[*4,5,6]Assistant Professor, Department Of Electrical Engg., S.C.E.T., Vihirgaon, Nagpur, Maharashtra, India.

DOI : https://www.doi.org/10.56726/IRJMETS32883

ABSTRACT

This is a new configuration of single-phase hybrid inverter with integrated battery energy storage suitable for residential use in this white paper to maximize local consumption of solar energy and reduce reliance on support . A hybrid inverter is called a Direct Storage Hybrid (DSH) inverter. Connect photovoltaic (PV) panels to loads and grids using transformerless topologies such as HERIC, which operate at low frequencies and produce three-level square wave output voltages. An active series filter is used to cancel the harmonic content from the square wave voltage and provide a sinusoidal voltage. A bi-directional DC/DC converter connects the battery to the PV panel and controls the charging state of the battery (SoC), optimizing the operation of the PV panel in both off-grid and grid-connected modes. The DSH inverter bypasses the battery DC/DC converter and can be connected directly to the inverter stage, greatly increasing throughput efficiency when using batteries. This document presents his DSH inverter operation and loss analysis in off-grid mode.

Keywords: Renewable Energy, Solar Panels, Inverter, Stabilizer, Consumer, Battery, Electricity Generation.

I. INTRODUCTION

The sun is her one of the most promising renewable energy sources. Solar energy can be converted into both electricity and heat. Environmentally friendly, no harmful emissions during conversion. Solar energy gained momentum in the mid-2000s when the EU began implementing policies to reduce its reliance on hydrocarbons for power generation. Another goal was to reduce greenhouse gas emissions [3]. Solar energy systems are increasing dramatically around the world. As early as 2016, the International Energy Agency reported that there are more solar farms than coal-fired power plants[9]. Russia is no exception to this trend.

In practical renewable energy applications (especially solar panels), it is widely used to convert VDC in series and parallel connected solar cells to VAC using an inverter feeding a load. As a general rule, inverters should be powerful (high specific power, high efficiency, high power factor, etc.) and deliver high quality power, recognizable by their sinusoidal voltage curve, frequency, and voltage stability. A low frequency filter must be installed downstream of the inverter to obtain high quality power. [1] So the solar panel inverter is the heart of the solar park and is designed to convert direct current to alternating current. There are three types of inverters for different applications. Off-grid inverter. They are part of an isolated photovoltaic system as they are connected to the solar panel and have no interface to the external power grid. Power varies from 100 to 8,000 W. Grid-connected inverter. These are synchronized with the central grid. They act as converters and adjust network parameters (amplitude deviation, frequency values, etc.). Multi-function inverter. These combine properties of his two other types and have greater configurability.

Air pollution from CO2 emissions is a constant problem facing the world, posing a particularly great threat to the environment and health. Therefore, it becomes imperative to search for energy sources with the lowest carbon content. Renewable energy sources are widely recognized as a viable option to overcome this problem

The use of solar energy will expand dramatically. In 2017, 17% of all electricity consumption worldwide was generated directly from solar energy. In 2018, 26.2% of the world's energy was generated by solar energy. It will reach 45% by 2040 [1]. The most common use of solar energy is to convert sunlight into usable electricity. Solar cells are connected in series to form a photovoltaic (PV) module [2]. Proper use of transformers, control circuits and switching circuits to vary voltage and frequency. Inverters are used in a wide variety of

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:01/January-2023 Impact Factor- 6.752 www.irjmets.com

applications, from small switching power supplies in computers to large-scale applications that transport vast amounts of energy. A residential solar inverter is one that produces AC power at grid frequencies from his DC power in photovoltaic (PV) solar panels. The Internet has greatly changed the design of most electronic systems. From small applications to complex industrial systems, today all use connectivity as an integral part of their function. Introduction of sensor systems and IoT that collect data and pass it to the cloud, such as temperature monitoring, heating control, inverter battery level, usage time consumption, etc.

II. LITERATURE SURVEY

A large number of national and international studies have been conducted to study the opportunities of reducing electricity consumption and improving energy efficiency of institutional and governmental buildings during rush hours. These studies show that, it is quite possible to limit the increase in energy use without having negative effects. So, the Government of Egypt has set a strategy to implement a number of polices up to year 2022 to diversify energy resources and rationalize the energy needs of different activities without hindering the development plans. Among these polices are taking executive actions to increase energy efficiency in order to reduce total energy consumption by 8.3 % by the year 2020, and achieving an electricity generation mix composed of 20 % RE, by year 2022.

When an AC power goes off, the storage supplied by the battery should be maintained the batteries would be precisely charged by solar AC grid source on night-time or muddy weather when source light is obtainable in any case of AC line status would be charged battery [4].Introduce solar in addition to wind hybrid energy system also the main supply. This design allows three power sources to power the battery and power the load independently and simultaneously based on power availability. This applies to hilly/rural areas. Hybrid design of battery systems and their implementation is a research topic [5]. This paper is designed to obtain a battery that limits solar energy. The solar charging system has an inverter powered by a 12V battery, which produces up to 230V AC. The battery is therefore charged from two sources: mains power and solar energy. If mains power is available, the relay switches to mains power [6] and applies the load. It has an inverter powered by a 12V battery with the help of a solar charging system Useful for creating 110V AC power circuits and large load transformers. Solar panels can be used as stand-alone systems or as large grid-connected solar systems [7]. Earth receives 84 terawatts of power and absorbs only 12 terawatts. The PCS operates in grid mode during normal operation and can also charge the battery [8]. It operates in normal mode during line-side faults and can use regulated loop relationships to supply current to local loads and balance setpoints [9]. Bi-directional diode converter connected PV diodes to control battery health and optimize PV poles. This process improves the efficiency of the inverter in the battery [10]. Hybrid inverters are primarily powered by wind turbines. Solar energy can be used as an uninterruptible power supply and can be used in different modes such as solar, industrial, hybrid and battery power, so that it can be charged with a certain amount of power injection under all conditions. It will be sent. If solar and wind modes don't work, enable hybrid mode and it will work. The paper [11] is primarily based on the design of solar inverters required to run AC loads used as combustible motifs. The drawn inverter has an output power of 100W, an input voltage of 12V, an output of 220V, and a square wave output of 50Hz. The paper [12] is the design and fabrication of a 1 kW SPWM inverter that converts an applied DC voltage from a solar array into a pure AC sinusoidal voltage and a standard mains output frequency of 220 V 50 Hz. An economical and advanced 16-bit PIC microcontroller is used to generate a common SPWM with a very high carrier frequency to control the inverter circuit. The paper [13] shows that grid-tied PV inverters have control strategies. This system study is completed under his LVRT conditions.

The plan is based on a current loop under the axis along the rotating coordinate system. Grid-connected PV systems have their own 3-phase inverter-bit DC-DC converters to handle the maximum power point. Their project considered a 100 kW PV system. In [14] his microcontroller-based Grid Tied Solar Inverter (GTSI) was designed and developed. Remember that solar power is expensive. A MOSFET circuit is used to improve DC-AC conversion efficiency. The paper [15] used a microcontroller and a cascaded H-bridge topology to improve the efficiency and reliability of systems used in multilevel solar PWM inverters. We also recognize the need to track the maximum power point for efficiency. The main subject of the paper [16] is the configuration of an inverter that can convert DC power supplied by photovoltaic (PV) cells into AC power used to drive a three-phase induction motor.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:01/January-2023 Impact Factor- 6.752 www.irjmets.com

In publication [17], a method of sinusoidal pulse width modulation (SPWM) for three-phase inverters was proposed. The authors demonstrated a simulation study of an inverter designed with a 50 Hz transformer sub-topology and reported in [17]. The results reported in this paper relate to the actual design of the SPWM inverter and its simulation based on the mathematical model. Output voltage regulation studies are done in relation to variations in battery voltage, sampling frequency, and various loads. Regulation has been observed to be within +10% of the expected output power over the 7.5 to 12.2 V battery range. But you need to trigger battery voltage above 13V, sampling frequency 10KHz and this output 230V[18;19;20;21].

III. DESIGN METHODOLOGY

First, there are power electronics that use solar inverters to generate alternating current. It consists of various components such as solar cells, batteries, inverters, filter circuits, and other electrical components that convert solar or battery power into AC power that can be used in consumer electronics and industrial applications. [3]. Secondly, intelligent solar inverters are used for wireless data communication related to all the different parameters related to the inverter, such as power consumption and time spent on starting various loads. Devices such as Arduino controllers, ESP8266 WiFi modules, crystal oscillators, and LCDs are used for this functionality. They are used to conveniently and easily provide information directly to the user about the inverter's running time, load consumption, used battery, etc.

IV. SOLAR POWER INVERTER

When solar energy is insufficient, the inverter uses batteries to power the load. When the sun's rays hit the photovoltaic system, the electrons start moving, creating a direct current. A photovoltaic power generation system is a power system that converts solar energy captured by solar panels into direct current. Household appliances primarily operate on single-phase AC power [3]. To generate AC power, a solar inverter is used that converts the variable DC output from the photovoltaic panel to AC power. You can supply this AC power supply to your home to power your devices. Surplus electricity can be fed to the grid (transmission lines) or to a home storage battery.

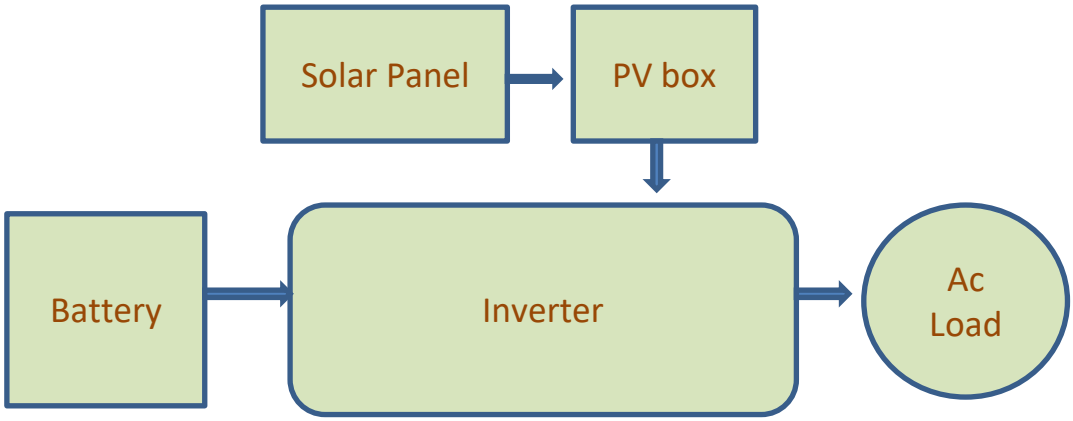

Fig. 1 - Inverter block diagram

V. INTERNET OF THINGS (IOT) INTERFACING WITH SOLAR INVERTER

Internet of Things (IoT) Interface with Solar Inverters: Wireless technology is added to traditional circuits to make the solar inverters easier to use. Various wireless technologies such as Zigbee, Wifi, Bluetooth and GSM are available. Wifi is cheap and very suitable for home automation, so it's easy to consider. Devices such as computers, tablets and phones can be easily connected to WiFi for easy monitoring. However, any two hardware components can connect to each other using wireless technology [5].

VI. EXISTING SYSTEMS

Conventional energy sources are generally non-renewable energy sources, have been in use for a long time, and are so widely used that known reserves Significantly depleted (e.g. our oil will be used in decades) and our coal reserves are expected to last another 100 years.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:05/Issue:01/January-2023 Impact Factor- 6.752 www.irjmets.com

VII. CONCLUSION

This paper proposed a new concept of smart single-phase hybrid inverter called direct storage hybrid inverter, which can optimize the throughput path of battery storage. Simulation results demonstrated the feasibility of the DSH inverter and showed stable operation under various PV conditions. It has been proven that DSH inverters can achieve very good throughput efficiencies of over 96%. This superior performance is especially important for maximizing local consumption, reducing dependence on the grid, and increasing the availability of residential PV battery systems.

VIII. REFERENCES

[1] N. T. Isembergenov, "Multistage Inverter for Solar Power Conversion," Elektricity, is. 7, pp. 32–37, 2011.

[2] Solar Panel Inverter: Types, Models, and How to Connect Them. [Online]. Available: https://sovet-ingenera.com/eco-energy/sun/invertordlya- solnechnyx-batarej.html

[3] Development of Solar Energy Worldwide. [Online]. Available: http://electricalschool.info/energy/1545-razvitie-solnechnojj-jenergetikiv-mire.html

[4] Imtiaz, Masudul Haider, MST RUMANA AKTAR Sumi, KAZI RIZWANA Mehzabeen, MD ISTIAQ MAHBUB, and NAFISA SHAHERA NUR. "Design & implementation of an intelligent solar hybrid inverter in grid oriented system for utilizing PV energy." International Journal of Engineering Science and Technology 2, no. 12 (2010): 7524-7530.

[5] Layyar, Srashti, Tushar Saini, Abhishek Verma, and Ashwani Kumar. "Hybrid Inverter with Wind and Solar Battery Charging." International Journal of Engineering and Technical Research 8, no. 7. 2018

[6] B. Ravi teja,2 Dr. G. Jayakrishna,3Akhib Khan Bahamani "hybrid inverter with solar battery charging" Journal of Emerging Technologies and Innovative Research 2018 JETIR July 2018, Volume 5, Issue 7

[7] Ashiq P A , Anand P H , Akhil Suvarnan , Lithul Krishna , Rejoice Thomas Paul , " Hybrid Inverter with Solar Battery charging ". Global research and development journal for engineering ,national conference on emerging research trend in electrical and electronics engineering, May 2019

[8] Kapil S. Sonare , Palash N. Meshram , Mayur R. Choudhary "Literature survey for sun tracking Hybrid Solar Inverter" International Journal of Research Available at Journals Volume 05 Issue 12 April 2018.

[9] Subramaniam, Umashankar, Sridhar Vavilapalli, Sanjeevikumar Padmanaban, Frede Blaabjerg, Jens Bo Holm-Nielsen, and Dhafer Almakhles. "A Hybrid PV-Battery System for ON-Grid and OFFGrid Applications—Controller-In-Loop Simulation Validation." Energies 13, no. 3 (2020): 755

[10] Jagadeesh, Y. "A new concept of intelligent hybrid inverter for battery charging." 2020

[11] Vijay Sarade , Sarade, Prof B.G.Hogade "Hybrid Inverter Incorporating Solar , wind,battery, on grid and off grid"Journal of Engineering Research and Application Vol. 9,Issue 5 (Series -II) May 2019, pp 29-32

[12] Gaurav Arora, Neha Aggarwal, Debojyoti Sen, Prajjwal Singh "Design of solar power inverter" International Advanced Research Journal in Science, Engineering and Technology (IARJSET) National Conference on Renewable Energy and Environment (NCREE-2015) IMS Engineering College, Ghaziabad Vol. 2, Special Issue 1, May 2015

[13] Hannan, Sundas, Sohaib Aslam, and Muhammad Ghayur. "Design and real-time implementation of SPWM based inverter." In 2018 International Conference on Engineering and Emerging Technologies (ICEET), pp. 1-6. IEEE, 2018.

[14] Ashokkumar, Mr R., Raajeshwar Elangovan, K. Vinoth, and S. Vijayakumar. "Analysis of SPWM Technique for Solar Inverter." International Journal of Engineering and Applied Sciences 5, no. 3: 257254.

[15] Hossain, Md Nahid, Tushar Kanti Routh, Abdul Hamid Bin Yousuf, Miah Md Asasduzzaman, Md Iqbal Hossain, and Ummul Husnaeen. "Design and development of a grid tied solar inverter." In 2012 International Conference on Informatics, Electronics & Vision (ICIEV), pp. 1054-1058. IEEE, 2012.

[16] Krishnan, Nithin, and H. Divya. "Solar Smart Inverter: A Novel Design using Multi level Topology and Pulse Width Modulation with Load Detection." International Journal of Engineering Research and 4, no. 06 (2015).

[17] Shubhangi Landge, Ankita Jadhav, Pranali Bomble, Muqadas Khan "Design of solar inverter" Vol-3 Issue-2 2017 IJARIIEISSN(O)-2395-4396

[18] T.B. Mohite Patil, , S.R. Sawant ,"Mathematical and simulation model of an SPWM Inverter" International Journal of Electronic and Electrical Engineering. ISSN 0974-2174 Volume 4, Number 1 (2011), pp.23-32.

[19] Bhambulkar, A.V. (2011). Municipal Solid Waste Collection Routes Optimized with ARC GIS Network Analyst. International Journal Of Advanced Engineering Sciences And Technologies, 11(1): 202-207.

[20] Ganorkar RA, Rode PI, Bhambhulkar AV, Godse PA, Chavan SL. Development of water reclamation package for wastewater from a typical railway station. Int J Innov Technol Res. 2014;2(2):841–846 http://ijitr.com/index.php/ojs/article/view/288/pdf.

[21] Rahul Mishra and Vaibhav Dewangan, —Optimization of Component of Excavator Bucket, International Journal of Scientific Research Engineering & Technology (IJSRET), Vol. 2, Issue2, pp 076-078, May 2013.

[22] John, B. (2012). Analysis of effectiveness and outcome of organizational development interventions in Bhilai Steel Plant. PhD Thesis; School of Management Studies & Research;MATS University, Raipur (India).