JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

SOLAR OFF GRID SYSTEM BY USING BIFACIAL SOLAR PANELS AND LITHIUM STORAGE BATTERIES

[1]Supriya R J, [2]P B Manoj
[1]Student,[2]Proffesor
Electronics and communication
AMC Engineering College, Bangalore, India

ABSTRACT— Solar energy has important and incredible potential to our daily lives. Few researchers suggest that the amount of solar energy or sunlight that strikes the earth surface in an hour and half is most enough to handle the entire world's energy consumption for a year. Solar energy system is one of the best renewable energy systems, which are not only cost effective but also environment friendly. In this design methodology, solar off grid system is defined as "it is stand alone or independent system that are not connected to the any other electrical grid or system. The most important and new technology method used in this project is bifacial solar panels instead if traditional or mono facial solar panel sand lithium storage system instead of lead storage system. Bifacial solar panels that can absorb the sunlight from both front and rear end. This mechanism helps the solar panels to absorb the energy from both the side and enhance the energy efficiency and boosting the electricity production. By using bifacial solar panels, we can generate the 30 per cent increase in the productivity. Solar panels are set of the photovoltaic cells. This absorbs the sunlight, the electrons are absorbed by silicon and they flow between n and p layers to produce electricity. This charge flow can be controlled by charge controller. This can be stored in the lithium storage batteries (new technology) and is connected to the inverter. By the inverter AC current can be directly used to the home appliances.

Index terms: Solar energy, energy yield by off grid system, Bifacial solar panels, Lithium storage, improvedenergy productivity.

I. INTRODUCTION

Solar energy is the most abundant form of energy available to us. Global energy demand is increasing rapidly due to the high rate of technology and population. Kind of the Energy or electrical power is required to operate new technology gadgets. Also, electrical power is an essential component for the economic development of the country because of the modern civilization, agricultural im provements and industrial expansions are depends on the available energy resource. Most significant portion of the energy is generally produced by the burning of the fossil fuels. So, it is mainly having an adverse effect on the environment. It releases CO into the atmosphere which responsible for greenhouse effect and also causes the ozone layer to be depleted. And most of the country's facing more problems due to the unconditional supply of electricity. Renewable energy based distributed energy systems are the most effective solution to both of these problems. Solar energy is most widely available source of renewable energy and cost free. The process of converting the solar energy into electrical energy is realized mainly through photo voltaic (PV) systems. Solar power is the use of the sun energy either directly as thermal energy or through the use of PV cells in the solar panels, transparent PV glass or Bifacial solar panels. These solar panels are made up of series of PV cells. Solar cells are made up of semiconductor materials such as silicon, which is used to produce electricity. The solar power is considered as a stream of tiny particles called electrons and the stream is called electric current. Typical solar cell has two layers of silicon, which is n - type at the top and p-type at the bottom. When sunlight strikes the bifacial solar panels, the electron or energy absorbed from the both the side, they flow between n and p layers to produce electric power. Generally produced solar power is in the form of direct current, it can be converted into alternative current by using inverter.

II. PROBLEM STATEMENT

A problem statement describes the analysis of Bifacial solar panels and Lithium -ion batteries used in Solar off grid systems. This can be obtained by analyzing the system with and without reflection of the radiation on the backside of the Bifacial solar panels.

III. OBJECTIVE

To study the basic operation of a solar off grid systems using transparent Bifacial solar panels and Lithium -ion batteries. To learn the advantages and limitations of the solar off grid system with the future scope of maximizing the use of it in day-to-day life.

IV. LITRERURE SURVEY

[1] S.S.Rangith have proposed the method to implement the off grid PV system for Electrification purpose and how to improve the system design. And also focuses on the system Setup can be extended for extra load connection for the remote control in rural areas. [2] Asif Ur Rehman have proposed the method to provides the information of an off grid PV cell in the system and how to satisfying all the electrical needs of the house throughout the year and guide the data about the solar Irradiance, temperature and humidity for the solar panels installation. [3] Prasad Gopi have proposed the design of the standalone solar PV system for the domestic applications. Also provides the data for calculation of the power based on the daily Load profile and geographical location of the place. [4] Yacouba Moumouni have proposed the method the idea about the sizing of the panels to smooth out the intermittent solar power. Provides the information about the current real per capita energy consumption, average household size and total population data were utilized to conduct the panel generation. [5] Chaudhry Bilal Muzaffar have proposed the method to provides the data about the how to use and wiring the batteries, PV modules to make a DC system that would be sufficient enough to provides the Requirements of home with the load of 7.81 KW per day. [6] Immad shams ha ve proposed the method to guides the data about optimal sized lithium-ion battery is designed and connected. The smart control system from overcharging and deep discharge conditions. And the MPPT is equipped with the system. [7] Mehdi Alimardani have propo sed the method to the information about the new HESS configuration using Lithium - ion batteries and the different modes of operation are explained. [8] Emest Sng have proposed the method to observe the more output compared to the traditional mono facial solar panel and the accuracy of the results can be examined through the simulation.

V. PROPOSED MODEL

The solar off grid refers the stand alone system, which is adequate for a living without depend on the ant electrical energy. Electrical energy in the off grid system would be produced through the bifacial photo voltaic panels, this energy needs to be stored or saved because requirement from the load can be different from the solar panel output, battery bank is also used. This system contains the solar bifacial panels, charge controller, battery storage and inverter. When system generate the energy more than the load it will automatically transfer to the linked utility grid. In the residential setups grid connected rooftop system usually having the capability of 10 kilowatts which could be enough to meet the house requirements. The excess energy would feed the grid which can be used by other consumers connected to the grid. The feedback or excess power transfer system works through a meter to track the transferred power. In some instances, PV system wattage could be less than the normal consumption due to several different factors. In this case, consumers will use the grid energy.

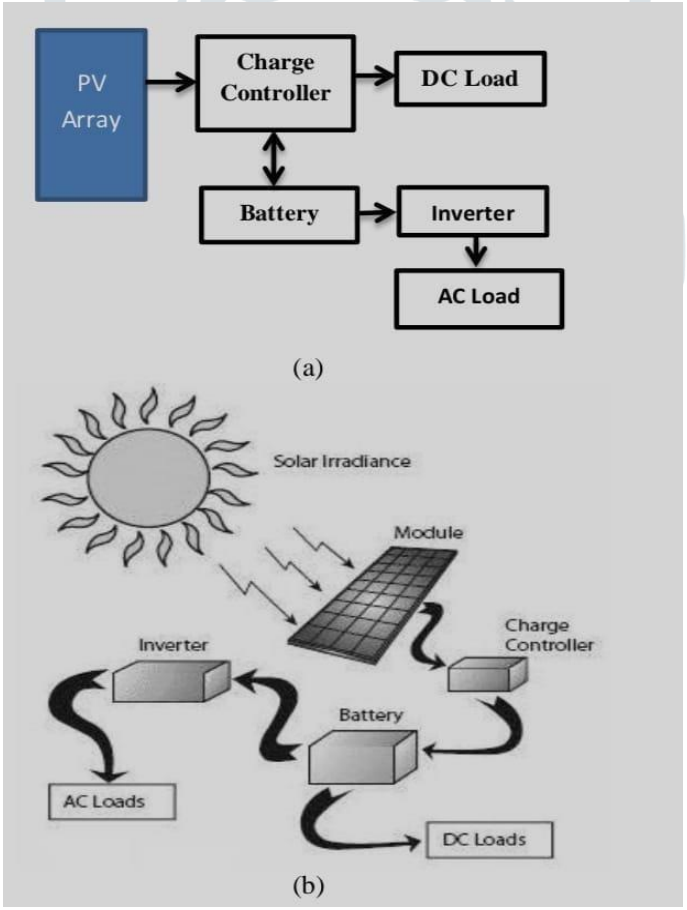

Fig 1. (a) Block diagram (b) Schematic diagram

5.1 BIFACIAL PV MODULE

Bifacial panels are the solar panels that can absorb sunlight from both the front and rear end. The bifacial solar panels are different from the conventional panels as they come with solar cells equipped on both sides. This mechanism helps the solar panels to absorb the solar energy from both sides, that enhances the energy consumption, efficiency and durability. The main dif ference between the mono facial and and bifacial modules is the use of the double glass or the transparent back sheet to allow for rear irradiance collection in bifacial PV modules. Diffuse sky and direct beam solar irradiance are calculated for the rear o f the module based on the incidence angle and sky factor. Below table shows the specification of the PV module.

Specification	Value
Cell type	Bi-Crystalline
No.of cells	6 × 10
Maximum power	300 W
Operating voltage	32.25v
Operating current	9.33A
Open circuit voltage	39.82V
Short circuit current	9.78 A
Module efficiency	18.24%
Maximum system voltage	1000 VDC UL
Maximum fuse voltage	15 A

Table 1: Specification of Bifacial solar module

5.2 CHARGE CONTROLLER

The charge controller is also known as photovoltaic controller or charger, is necessary for the system which involves a battery. The main capacity of the charge controller is to counteract the battery spoofing. The main function of the charge controller is to monitor the charging and discharging of the battery. It prevents the battery from being completely charged or discharged. This is important because over charging can lea d to destruction of the battery and under charging decreases the battery life. Important reason to use a charge controller is to prevent a reverse current flowing from battery to the system. Mainly there are two types of controllers that can be widely used in the solar system. They are pulse width modulation (PWM) and maximum power point tracking (MPPT). Below table shows the specification of the charge controller.

Table 2: Specification of charge controller

Specification	Value
Normal voltage	220 V dc
Rated charge current	100 A
Maximum input voltage	275 V dc
Maximum input power	22000 W
Charge loop drop	<0.5 V
Discharge of pressure drop	<0.3 V
Over voltage switching off	294 V
Under voltage recovery	198

5.3 INVERTER

Inverter converts the DC from bifacial PV modules to AC. It ensures that the condition of the AC waveform is suitable for the applications. It also reduces the voltage variations. In the off grid systems, most system connected inverters can be introduced externally, and most of the inverters are not weather- resistant. Basically, there are two types of grid intelligent inverters, those designed for batteries and those designed for systems without battery- connected inverter systems. They provide excellent void quality strength. Inverter used for the solar PV systems are usually based upon the total wattage of the solar panels, as the inverter will be continuously converting the power generated. And it is also investigating the voltage level of the system. For the stand alone systems, the inverter must be large enough to handle the total amount of power that will be used at one time. The inverter size should be 25 -30% (safety factor) bigger than total power of appliance. Below table defines the specification o f the inverter.

Specification	Value
Rated power(KVA)	40/50/60 KVA3
Rated dc voltage	230/360
Nominal voltage	380 V ac
Nominal frequency	50/60 HZ
Output waveform	Pure sine wave
Operating temperature	0-40 degree C
Noise db	45-55db
Inverter efficiency	92%
Weight	50-100(kg)

Table 3: Specification of inverter

5.4 LITHIUM STORAGE BATTERIES

Since solar off grid system is operational during the day. Batteries plays very important role in the energy system. They are used for energy storage during the day. Basic PV principles and various methods, indicates that is in any photovoltaic system that includes batteries, the batteries becomes the central component of the overall system. Which is significantly affects the cost, requirements, reliability and design of the photovoltaic system. In the traditional method of solar system lead storage batteries are used. In order to increase the energy efficiency and energy density, in the modern methods lithium - ion storage batteries are used. In the solar system some batteries are connected in series and some of them are connected in parallel. Below table sh ows the specification of the storage batteries.

Specification	Value
Article number	BAT412151104
Ah	165
Voltage	12V
Ixwxh (mm)	485×172×240
Weight (kg)	28
CCA@0 degree F	550
RES CAP @ 80 degree F	200

Table 4: Specification of Lithium storage batteries

VII. RESULTS CONCULSION

The purpose of this project is to design a solar off grid system using Bifacial solar panels and Lithium -ion batteries for storage. Lithium-ion batteries have shown a great rate of charging and discharge. The life cycles of the batteries are higher than the conventional lead acid batteries. The Bifacial panels show increased yield when the tilt is provided where the radiation is reflected and incident on the backside of the solar panel. The yield is seen to be increased by 20-30%. Further adding a bright layer gives an increased yield of another 5 -10%. This yield changes can be clearly observed using a multimeter.

VIII. FUTURE SCOPE

Bifacial module production is still in the initial stages. Increasing the usage of Bifacial solar panels will decrease the area required to generate specific power. These solar panels can be developed into roofing solutions which provide ambient light for the indoors. Agricultural applications can use these solar panels as sufficient natural light passes through the Bifacial solar panels.

IX. REFERENCES

[1] S.S.Rangith, C.F.Tan, S.K.Subramaniam "Implementation of an off-grid solar Powered technology"published in 2011 in second international conference on intelligent system, modeling and simulation.

[2] Asif Ur Rehman, M.Tariq Iqbal "Design and development of an off-grid solar system for a rural house in Pakistan" published in 2011 in IEEE conference.

[3] Prasad gopi, M.Ramesh, M.Padma Latitha "Practical design of an off-grid solar PV system for domestic application" published in 2021 in IEEE international conference.

[4] Yacouba moumouni, Munther gdeisat "Sizing an off- grid photovoltaic system" published in 2018 in advances in science and engineering international conference.

[5] Chaudhry bilal muzaffar, M.Tariq Iqbal "Design and analysis of off grid solar system for DC load of house in Pakistan" published in 2020 in 11th IEEE annual information Technology, Electronics and Mobile communication conference.

[6] Immad shams, prashanth srivatsava, Saad mekhilef "Design and implementation of Lithium -ion Battery based smart solar system". Published in 2020 in IEEE energy Conversion congress and exposition.

[7] Mehdi alimardani, Mehdi narimani "The new energy storage system configuration to Using Lithium -ion batteries". Published in 2021 in IEEE Canadian journal of electrical and computer engineering c onference

[8] Emest sng, Sai wei Chua, Scott roy "Solar energy simulation of Bifacial panels for performance optimization" published in 2020 in 47th IEEE photovoltaic specialist conference.