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Off Grid Based Solar System

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ABSTRACT: Solar energy is the cleanest and most developed form of renewable energy. In order to be completely independent of the grid source we need to have off grid solar system. This project presents a model in which we have designed an off-grid DC solar system using homer pro. The system will consists of solar array together with batteries as an energy storage. During day time we get more power than our requirement. So we don't require to access main supply. The surplus energy will be accumulated within the battery storage units through charge control. And whenever load is increase or night time then it'll automatically start using stored energy. It's recommended that this technique should be present in rural area due to heavy power bring to a halt in rural area.

KEYWORDS: Solar panel, Sunlight, Portable, Battery, Portable Bank

I. INTRODUCTION

The Solar energy is a viable source of generating electricity, photovoltaic is the direct conversion of the solar energy into electricity. It can be used in number of applications. Solar Energy is very useful where the climatic conditions are appropriate. This source of renewable energy is a feasible and sustainable source of energy generation in the regions where Sun is incident on the surface for 6 to 10 hours. This project is about installing an off-grid Hybrid PV system in a house or building. Though, the capital cost is high, but operation and maintenance charges of the PV system are very low. System installation and component selection is very critical in this project as it would affect the cost analysis and may prolong the payback period and make the project financially infeasible as well as alternative to the conventional sources of the energy which are affecting the environment. The simple hybrid PV system. Basic Hybrid PV System.

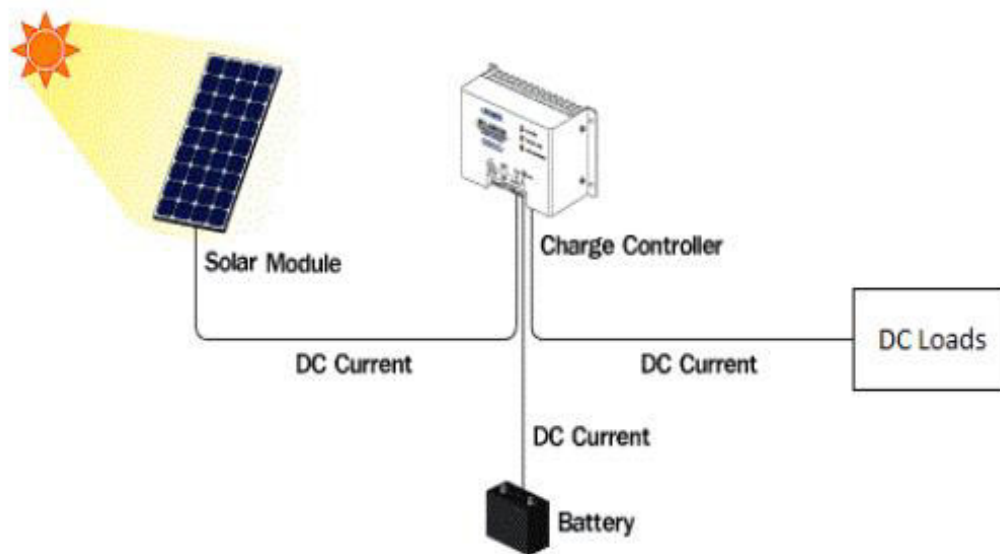
II. RELATED WORK

The Solar PV system has number of components when installed together produces electricity. Components should be selected according to the load requirements and applications. PV module is the major component of the PV system, it is made from the semiconductor (Si), which converts sunlight to electricity. Photovoltaic effect causes semi-conducting materials to absorb photons of light and release electrons. Each Band gap in the material has a potential difference of 1 eV. Each PV cell is connected to form array of PV module. The output of Silicon PV cell is 0.5 V The most common types are amorphous-Si, mono-crystalline and poly-crystalline. Amorphous Silicon has high final yield but the crystalline modules are efficient and high-capacity factor. The energy when not in use for load is stored in the battery bank of specific requirement and will be used in night or days of autonomy. Lithium-Ion are the most expensive due to high energy density. Solar panels are made of different materials. The batteries material is also important in storage of electricity. As the material will be able to store more charge the battery last longer. In this regard the best option is lithiumion battery. In the previous discussion it has been established that there is abundance of solar energy available to be harvested. A brief discussion of what PV cells is also being covered. It is necessary that we understand how these cells generate electricity so that we can design systems that can be in tandem with these basic concepts. The following discussion will explain how the cells generate electricity. Sun is a powerhouse of energy and this energy moves around in the form of electromagnetic radiations. depending upon the wavelength of the radiations emitted. A very less percentage of sun's radiations reach the earth's atmosphere in the form of visible light. Solar cells use this visible light to make electrons. Different wavelength of light is used by different solar cells. Solar cells are made up of semiconductor materials, such as silicon, which is used to produce electricity. The electricity is conducted as a stream of tiny particles called electrons and the stream is called electric current.

III. METHODOLOGY

They reduced the battery bank size by 2.5 percent and also reduced the cost of power by half. They have used 48 V DC as system voltage and used this same voltage for both the battery bank and consumption line. The AC voltage is put in optional for this system. Thus, they improved the existing DC models. Additionally, they used blue tooth interface and operated thus proposed a method in which you can remotely access the solar in range of the bluetooth. hey combined all of them to provide the off-grid power DC power solution. They used homer for the system designing and the Simulink for dynamic modelling. Wide range of the data has been collected for this purpose and organized in proper manner. hey combined all of them to provide the off-grid power DC power solution. They used homer for the system designing and the Simulink for dynamic modelling. Wide range of the data has been collected for this purpose and organized in proper manner. They aggregated the power using the multiple solar house system. The modified IV loop is studied and the MATLAB is used in the dynamic modelling of the system. They used battery storage, local load PV and wind a component for their system. They integrated the main power and the solar line in such a way that normally the system will provide the power but in case the power is low than it will manage the load with the transmission lines and thus there will be no interruption. This hybrid model consists of multiple energy sources such as biomass fuel gas, fuel cells and solar. This power for each of the energy source 5kW. the levelized cost per unit achieved is 15 Rs /kWh and per day production reached 100 kWh. He uses standard homer mechanism all data was collected and fed to homer and computed and simulated to find the optimum results.

IV. BLOCK DIAGRAM



Charge controllers, or power regulations circuits such as solar chargers with maximum power point trackers (MPPT), should be incorporated in the set-up of a PV system as they increase the overall performance by 30%. Basically, the losses in PV systems are due main lyto the ageing of solar cells and fundamental (unavoidable) and non-fundamental losses. These losses are corrected using conventional systems; these are the conventional Battery Voltage. Regulator (BVR) and a conventional Novel (BVR). The former is employed to balance the mis -match from the PV array to the battery (i.e., 15 BVR functions are to disconnect the load when itis deeply discharged and to disconnect the PV array when the battery is fully charged) while in the latter the PV array is never disconnected. During high insolation (radiation) periods, the load is supplied directly by the array through a chopper circuit, During low insolation periods, there is a need for a large PV array due to high load demand which leads to an unavoidable loss during high insolation

periods called “fundamental loss” resulting from the fact that the array power is larger than the load power. These conventional systems help to increase the overall efficiency and life span of the system. The angle of incidence for light striking a PV panel is also the angle of the direct beam radiation striking the surface and is a key factor that influences the output power of a PV panel. The best performance of a PV panel is obtained when the sun is perpendicular to the PV panel resulting in an angle of incidence. It has been found that energy losses are associated with angle of incidence more than when the PV panel’s angle of incidence exceeds. But as the sun moves across the sky from east to west, the angle of incidence varies drastically resulting in a subsequent decrease of solar energy falling in on the PV panel as more of the energy reflects off the glass rather than being absorbed by the PV panel.

V. OBJECTIVE

The purpose of this research is to develop a portable solar power bank that can be used in disasters. It contains a built-in solar panel that transforms sunlight into electricity. The charge is then transferred to a battery, and the battery is connected to a charging circuit with a USB connector as an output to the corresponding power bank. There are still certain parts of India that are without electricity. People in these rural places may charge their phones and other USB devices without needing energy using this solar power mobile charger. Solar energy is completely free. The sun's energy is completely free. Because humans get sunshine directly from the sun, the energy source is basically free. Solar energy is both environmentally benign and renewable. As a result, there is no natural contamination. It is less expensive, and once installed, it provides numerous advantages. Maintenance is fairly inexpensive. We will be able to run various USB gadgets by storing this energy in batteries (like USB fan, USB light). This solar power bank is unique. It operates on the power of the sun, converting solar to electrical and assisting in the charge of cell phones for communication, making it indispensable during calamities and power outages.

VI. PROCESS

The previous discussion it has been established that there is abundance of solar energy available to be harvested. A brief discussion of what PV cells is also being covered. It is necessary that we understand how these cells generate electricity so that we can design systems that can be in tandem with these basic concepts. The following discussion will explain how the cells generate electricity. Sun is a powerhouse of energy and this energy moves around in the form of electromagnetic radiations, depending upon the wavelength of the radiations emitted. A very less percentage of sun’s radiations reach the earth’s atmosphere in the form of visible light. Solar cells use this visible light to make electrons. Different wavelength of light is used by different solar cells. Solar cells are made up of semiconductor materials, such as silicon, which is used to produce electricity. The electricity is conducted as a stream of tiny particles called electrons and the stream is called electric current. Two main types of electric currents are; DC (direct current) in which the flow of current. A 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 solar cell, the electrons are absorbed by silicon, they flow between n and p-layers to produce electric current and the current leaves the cell through the metal contact. The electricity generated is of AC type.

VII. PHYSICAL PROTOTYPE

Grid connected photovoltaic power system is an electricity generating system which is linked to the utility grid. This photovoltaic system contains solar panel, inverter and the equipment to provide connection to the grid. Grid connected systems are feasible for various setup such as residential. Commercial and larger scale grid tied system different than the off grid solar power systems. Usually grid connected system does not need battery backup, because 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 systems usually having the capability of 10 kilowatts which could be enough to meet the house requirements, and the excess 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 and in this scenario, consumer will utilize the grid energy generates a 12 volt charge, which is sent to the battery. The charge transfer from the panel to the battery is shown via an LED. When the battery is fully charged, as shown by the four LEDs attached to it through the microprocessor, the microcontroller shows the percentage of charge left in the battery, at which time a mobile phone can be connected to the circuit's end. A relay circuit is also attached here to evaluate the voltage flow. If the voltage is too low or too high, the relay will turn off, leaving the circuit open.

VII. EFFICIENCY

We can see that at the start there is some disturbance in the current and voltage but after then it tends to stabilize and thus, we can achieve less oscillation. Initially the value are not stable but then it stabilized. As time passes on the voltage and current both tends to stabilize it. The value depicts the system. We can see that from the figure 9 behavior of different factor in the output waveform. The irradiance remains same w.r.t time as it the natural phenomena. The duty cycle show some different behavior. Temperature graph is somehow straight that indicates that there is not heating of the plates and the temperature remain same. for the power we see that power is low at the start but with increasing time the power rises. Voltage of the solar panel is less at the start but the after some time the voltage of the panel sudden rises and reach it nominal value. The duty cycle reaches a certain value and remain their w.r.t to time.

VIII. APPLICATIONS

Among all the benefits of solar panels, the most important thing is that solar energy is a truly renewable energy source. It can be harnessed in all areas of the world and is available every day. We cannot run out of solar energy, unlike some of the other sources of energy. Solar energy will be accessible as long as we have the sun, therefore sunlight will be available to us for at least 5 billion years when according to scientists the sun is going to die. Since you will be meeting some of your energy needs with the electricity your solar system has generated, your energy bills will drop. How much you save 29 on your bill will be dependent on the size of the solar system and your electricity or heat usage. For example, if you are a business using commercial solar panels this switch can have huge benefits because the large system size can cover large chunks of your energy bills. Moreover, not only will you be saving on the electricity bill, but there is also a possibility to receive payments for the surplus energy that you export back to the grid through the Smart Export Guarantee (SEG). If you generate more electricity than you use (considering that your solar panel system is connected to the grid).

X. HARDWARE DISCRPTION



A solar panel is actually a collection of solar (or photovoltaic) cells, which can be used to generate electricity through photovoltaic effect. These cells are arranged in a grid-like pattern on the surface of solar panels. Thus, it may also be described as a set of photovoltaic modules, mounted on a structure supporting it. A photovoltaic (PV) module is a packaged and connected assembly of 6×10 solar cells. When it comes to wear-and-tear, these panels are very hardy. Solar panels wear out extremely slow. In a year, their effectiveness decreases only about one to two per cent (at times, even lesser). Most solar panels are made up using crystalline silicon solar cells. Installation of solar panels in homes helps in combating the harmful emissions of greenhouse gases and thus helps reduce global warming. Solar panels do not lead to any form of pollution and are clean. They also decrease our reliance on fossil fuels (which are limited) and traditional power sources. These days, solar panels are used in wide-ranging electronic equipment's like calculators, which work as long as sunlight is available.



A solar charge controller is used to charge the battery by regulating and controlling the output from the solar PV array; it also protects the battery from being overcharged or over discharged. Overcharging of the battery creates release of hydrogen and oxygen gases from the electrolyte, which could cause explosion and failure. If the battery is allowed an excessive discharge of current, the battery charge will be drained. So, the life of the battery will be reduced and cause premature failure of the battery. Solar charge controllers redirect or switch off all or part of the array to reduce the current flow to the battery when it is becoming full. If the battery is discharged below a specified voltage, which is a low voltage preset point, the disconnection of some or all the loads takes place. To protect the battery from overcharging, the charge controller will have a high voltage disconnect (HVD) point. So, the controller will have set points such as low voltage disconnect 24 (LVD) and HVD. The controller voltage must be compatible with the nominal system voltage and it must be capable of handling the maximum current produced by the PV array.



A battery can be defined as an electrochemical device (consisting of one or more electrochemical cells) which can be charged with an electric current and discharged whenever required. Batteries are usually devices that are made up of multiple electrochemical cells that are connected to external inputs and outputs. Batteries are widely employed in order to power small electric devices such as mobile phones, remotes, and flashlights. Historically, the 'term' battery has always been used in order to refer to the combination of two or more electrochemical cells. However, the modern definition of the term 'battery' is believed to accommodate devices that only feature a single cell. Batteries are broadly classified into two categories, namely primary batteries and secondary batteries. Primary batteries can only be charged once. When these batteries are completely discharged, they become useless and must be discarded. The most common reason why primary batteries cannot be recharged is that the electrochemical reaction that takes place inside of them is irreversible in nature. It is important to note that primary batteries are also referred to as use-and-throw batteries. On the other hand, secondary batteries are the batteries that can be charged and reused for many charging-discharging cycles. The electrochemical reactions that take place inside these batteries are usually reversible in nature. Therefore, secondary batteries are also known as rechargeable batteries. When discharging, the reactants combine to form products, resulting in the flow of electricity. When charging, the flow of electrons into the battery facilitates the reverse reaction, in which the products react to form the reactants.

XI. CONCLUSION

There is a cost associated with electrifying houses in rural areas that increases with distance between the grid and the houses. Such instances where the cost of electrification becomes enormously high one can always use an off-grid PV system. Both type of systems viz. grid tied and off-grid PV systems have their own advantages and disadvantages. Depending solely on the need one can decide what they would want to go for. It is a trend that one can observe is that the grid-tied system is mostly found in urban and sub-urban settings where electrification of the area has already been achieved. The off-grid system is more suited to areas where the electrification is yet to be accomplished and/or the consumer chooses not to supply back the energy generated at his/her end. This paper provides the methodology of designing an off-grid PV system. Using a bus shelter at EIU an PV system was designed that would house certain necessary equipment such as WIFI module, charging points, lights, and sensors that would provide service to the students who would be using it. The design methodology is not limited to only bus shelters but could also be used for different purposes where ever a need of having an off-grid system arises. Economical aspect of the system has not been covered in this paper due to the availability of numerous vendors in the market. Upon identifying the system capacity, one can search the best option of different equipment depending on their financial preferences.

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