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A Brief Study of Home Solar Electric Module

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Abstract

Energy is an essential component of modern life. Solar system depends on the energy produced by the sun. Harnessing and utilization through old ways of sources causing worrying problems as depletion of resources and damage to environment. So switching to form which can be renewed s has been rapid in recent times. Energy reaching to earth through sun‘s radiation in form of photons, used by solar panels to get DC power, has vast probability. About half the incoming solar energy is absorbed by water and land; the rest is reradiated back into space. The total solar energy absorbed by Earth's atmosphere, oceans and land masses is approximately 3850 zetta joules per year. Photovoltaic cell is the direct conversion of energy from the sun into electrical energy. Solar energy is a form which can be renewed in alternative energy resources and it has a better advantage in electrical energy generation over old ways of sources of electrical energy. It was until the 1940‘s that people became interested in solar electrical energy generation.

Problem is that, different geographical regions experience different weather patterns, these geographical differences affect the photovoltaic system design, also the orientation of the panels. The use of appropriate batteries for the storage of energy is important. The charge controllers and the power Inverters used for conversion of that power gained and stored has to be converted to ac of rated frequency and voltage with reliability and efficiency.

A better solar electric module has to be developed for the most economical, simple and advanced system for most suitable infrastructure. The module created can absorb sun‘s radiation to create 20 watt power that is being stored to a lead acid battery and is controlled through a charge controller to interconnect all the systems together and provide rated dc to the Power Inverter which is IGBT based pure sinusoidal with ultra-fast trench technology used that has input values of 200 volt dc and another of 20 volt dc and output of 120 volt ac sine wave of 50 hertz frequency. This is to gain a more stable, pure, economical ac power for home appliances.

Keywords: Home Solar, IGBT, Power, Hertz, photovoltaic

Introduction

solar energy is radiant light and heat from the sun harnessed using a range of ever-evolving technologies such as solar heating, solar photovoltaics, solar thermal electricity, solar architecture and artificial photosynthesis Solar technologies are broadly characterized as either passive solar or active solar depending on the way they capture, convert and distribute solar energy. Active solar techniques include the use of photovoltaic panels and solar thermal collectors to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air. The Earth receives 174 petawatts (PW) of incoming

solar radiation (insolation) at the upper atmosphere. Approximately 30% is reflected back to space while the rest is absorbed by clouds, oceans and land masses. The spectrum of solar light at the Earth's surface is mostly spread across the visible and near-infrared ranges with a small part in the near-ultraviolet. Earth's land surface, oceans and atmosphere absorb solar radiation, and this raises their temperature. Warm air containing evaporated water from the oceans rises, causing atmospheric circulation or convection. When the air reaches a high altitude, where the temperature is low, water vapor condenses into clouds, which rain onto the Earth's surface, completing the water cycle. The latent heat of water condensation amplifies convection, producing atmospheric phenomena such as wind, cyclones and anti-cyclones. Sunlight absorbed by the oceans and land masses keeps the surface at an average temperature of 14 °C. By photosynthesis green plants convert solar energy into chemical energy, which produces food, wood and the biomass from which fossil fuels are derived.

History of Photovoltaic System

The first discovery of photoelectric effect was in 1839 by Edmund Becquerel, a nineteen years old French physicist. He found that certain materials would produce small amount of electric current when exposed to light in the 1860‘s an Electrician called Willoughby Smith was testing under water telegraph lines using a material called selenium. By chance he discovered that electrical energy traveled through selenium very well when it was in light, but didn‘t if the selenium was in darkness. In the late 1870‘s two American Scientists, Williams Adams and Richard Day became interested in this. They soon discover that the sun energy creates a flow of electrical energy in selenium.

The first old ways of photovoltaic cell were produced in the late 1950‘s and through the 1960‘s were principally used to provide electrical power for earth-orbiting satellite in the 1970‘s improvement in manufacturing, performance and quality of Photo Voltaic modules help to reduced cost and opened up a number of opportunities for powering remote terrestrial applications including battery charging for navigational aids signals telecommunication equipment and other critical low-power needs.

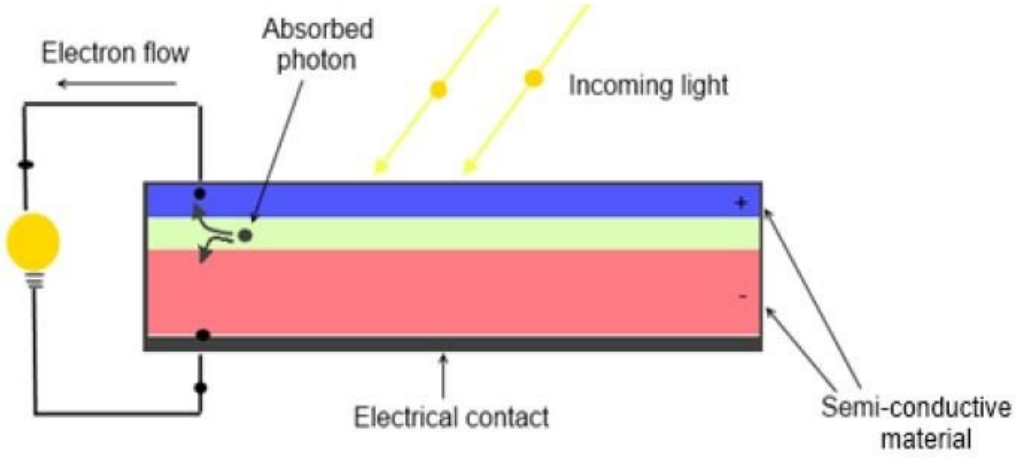

Fig.1: Two layers of semi-conductive materials in a PV solar cell

Solar Panels/Modules

Solar panels generate free power from the sun by converting sunlight to electrical energy with no moving parts, zero emissions, and no maintenance. Solar panels are also called as modules. These solar modules are usually used for consuming the solar irradiation.

Types of solar modules

These solar modules are characterised into three main types according to their efficiency and construction.

1. Monocrystalline solar panels
2. Polycrystalline solar panels
3. Amorphous solar panels

Types of solar photovoltaic system:

Solar Photo Voltaic systems can be classified based on the end-use application of the technology. There are two main types of solar Photo Voltaic systems: electric gridconnected (or electric grid-tied) and off-grid (or standalone) solar Photo Voltaic systems.

1. Grid connected solar photovoltaic system
2. Off grid solar photovoltaic system

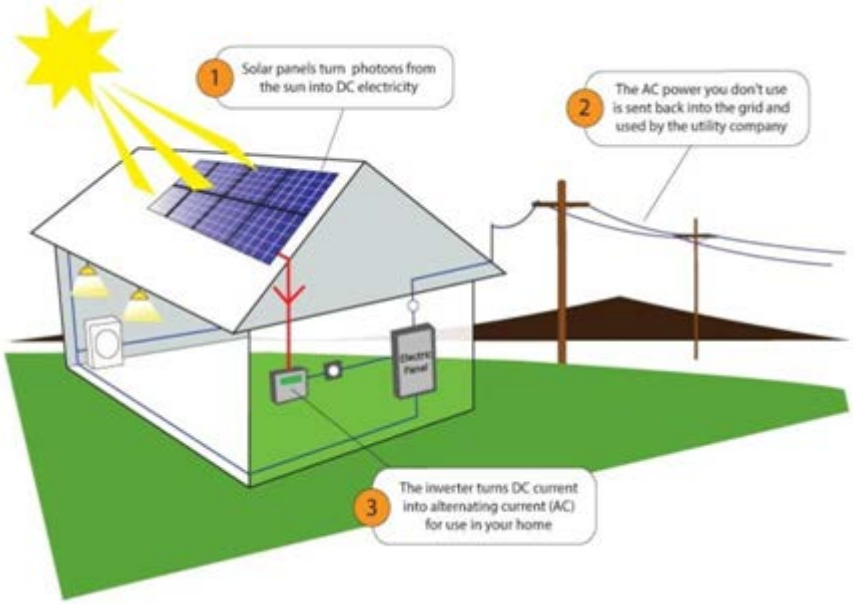

Fig. 2: Basic representation of home solar electric model

Charge controllers

T brighter the sunlight, the more voltage the solar cells produce, the excessive voltage could damage the batteries. A charge controller is used to maintain the proper charging voltage on the batteries. As the input voltage from the solar array rises, the charge controller regulates the charge to the batteries preventing any overcharging.

Power inverters

Power inverters are basically used for converting the direct current into alternating current. There are some types of inverters

1. Square wave power inverters
2. Modified sine wave power inverters
3. True sine wave power inverters

Batteries

Basically batteries are used for storing the charge or power. It is also known as fuel tank of solar power electric system. It provides power to the electrical devices. It consisting of one or more electrochemical cells with external connections provided to the power electrical devices.

Types of batteries

On the basis of usability of the system and need of supply

1) RV/MARINE / GOLF CART
2) FLOODED TYPES
3) GEL
4) AGM

Process of Home Solar Electric Modules

According to home solar electric module the solar energy generated through solar system and utilise the generated power in the domestic purposes load.

In this phenomenon there are the generated energy through the module is stored into the battery with the help of charge controller. Also it having on load generation where solar system can fulfil the load and also store the charge into batteries. Whenever the sun irradiation or solar generation decreases than there will be the load requirements can be fulfilled by the charge storage or batteries.

With the help of this system there will be the electricity generation can be done and utilise the power with the help of solar electric modules.

Advantages of Solar Power

- Solar energy is a clean and renewable energy source.
- Once a solar panel is installed, solar energy can be produced free of charge.
- Solar energy will last forever whereas it is estimated that the world's oil reserves will last for 30 to 40 years.
- Solar energy causes no pollution.
- Solar cells make absolutely no noise at all. On the other hand, the giant machines utilized for pumping oil are extremely noisy and therefore very impractical.
- Very little maintenance is needed to keep solar cells running. There are no moving parts in a solar cell which makes it impossible to really damage them.
- In the long term, there can be a high return on investment due to the amount of free energy a solar panel can produce, it is estimated that the average household will see 50% of their energy coming in from solar panels.

Disadvantages of Solar Power

- Solar panels can be expensive to install resulting in a time-lag of many years for savings on energy bills to match initial investments.
- Electricity generation depends entirely on a countries exposure to sunlight; this could be limited by a countries climate

- Solar power stations do not match the power output of similar sized conventional power stations; they can also be very expensive to build.
- Solar power is used to charge batteries so that solar powered devices can be used at night. The batteries can often be large and heavy, taking up space and needing to be replaced from time to time.

Conclusion

Photon is energy from the Sun in the form of radiated heat and light. It drives the climate and weather and supports life on Earth. Solar energy advancements in technologies and scinces make controlled use of this energy resource. Solar system depends on the energy produced by the sun. Photovoltaic cell is the direct conversion of energy from the sun into electrical energy. Solar energy is a form which can be renewed as alternative energy resources and it has a better advantage in electrical energy generation over old ways of sources of electrical energy. Solar Photo Voltaic Power generation systems are made up of interconnected components for converting sunlight into electrical energy by photovoltaic process, each with a specific function. Those components are array, balance of system and load.

A solar inverter or Photo Voltaic inverter is a type of electrical inverter that is made to change the direct current electrical energy from a photovoltaic array into alternating current for use with home appliances and possibly a utility electric grid. Inverters ensure an uninterrupted power supply. They can vary in size according to their capacity.

The energy of the absorbed light is transferred to electrons in the atoms of the Photo Voltaic cell. With their newfound energy, these electrons escape from their normal positions in the atoms of the semiconductor Photo Voltaic material and become part of the electrical flow, or current, in an electrical circuit. A special electrical property of the Photo Voltaic cell, what we call a "built-in electric field", provides the force, or voltage, needed to drive the current through an external "load," such as a light bulb.

Since the brighter the sunlight, the more voltage the solar cells produce, the excessive voltage could damage the batteries. A charge controller is used to maintain the proper charging voltage on the batteries. As the input voltage from the solar array rises, the charge controller regulates the charge to the batteries preventing any overcharging.

One of the major strengths of Photo Voltaic systems is modularity, as your needs grow individual components can be added or replaced to provide increased capacity. The intensity of the sun rays reaches the earth varies with time of the day, season, location, and weather conditions. The total energy on daily or annual basis is called irradiation and indicates the strength of the sun shines. Irradiation is expressed in Wh.m per day.

Different geographical region experiences different weather patterns, these geographical differences affect the photovoltaic system design, also the orientation of the panels, finding the number of autonomy where the sun does not shine in the skies, and choosing the best tilt-angle of the solar panels,

According to the estimate of the Electric Power Research Institute, roughly 70% of electrical energy in the USA now flows through power electronics, which will eventually grow to 100%.

The advanced inverter capabilities discussed in this report could clearly facilitate high penetration levels of Photo Voltaic generation and also lead to potential savings for utilities by reducing line losses and drastically reducing regulator switching operations, thereby extending the life of equipment, reducing maintenance costs, and possibly deferring the cost of new capacitor banks and other equipment.

The rapid growth of form which can be renewed as generations expedites the upgrading of Traditional electric grids, allowing more and more distributed generation connected at the

Customers‘ side. Distributed generation units use a wide range of generation advancements in technologies and sciences, Including gas turbines, diesel engines, solar photovoltaic (Photo Voltaic), wind turbines, fuel cells, Biomass and small hydroelectric generators.

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