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Short Communication

A GREEN ENERGY SOLUTION IN ELECTRIC POWER SYSTEMS IN ELECTRIC POWER SYSTEMS TO CONVERT SOLAR ENERGY TO ELECTRICITY

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DESCRIPTION

A photovoltaic (PV) system is made up of one or more solar panels, an inverter, and other electrical and mechanical components that use the Sun's radiation to generate power. PV systems are in a wide range of sizes, from portable systems to large utility-scale power plants. Although PV systems can run off-grid, this article concentrates on PV systems that are connected to the utility grid, also known as grid-tied PV systems.

Functions of these systems

The photovoltaic effect occurs when light from the sun, which is made up of packets of energy called photons, falls upon a solar panel and generates an electric current. Each panel produces a little quantity of electricity on its own, but when linked together as a solar array, they can create larger amounts of energy. Direct current is the type of power generated by a solar panel (Direct Current) [1]. Although many electronic gadgets, such as your phone or laptop, use DC electricity, they are designed to work with the electrical utility system which uses Alternating Current (AC) [2]. As a result, solar electricity must first be converted from Direct Current (DC) to Alternating Current (AC) using an inverter before it can be used. The inverter's AC electricity can either be used to power local gadgets or transferred to the electrical grid for use.

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Components of the system

There are other crucial components of a photovoltaic system that are generally referred to as the "Balance of System" or BOS, in addition to the solar panels, Inverters, racking, wiring, combiners, disconnects, circuit breakers, and electric meters are examples of these components (which often account for more than half of the system cost and the majority of maintenance) [3].

Solar Panels

A solar panel is made up of several solar cells that have semiconductor qualities and are encased in a material that protects them from the elements [4]. These characteristics allow the cell to capture light or more precisely photons from the sun and transform their energy into usable power *via* process known as the photovoltaic effect. A layer of conducting material is present on both sides of the semiconductor, which "collects" the electricity generated. An anti-reflection coating is also applied on the lighted side of the panel to reduce reflection losses. The vast majority of solar panels manufactured across the world are built of crystalline silicon which has a theoretical efficiency limit of 33% for converting solar radiation into electricity. Many other semiconductor materials and solar cell technologies have been discovered that are more efficient, but they are more expensive to produce.

Inverters

An inverter is an electrical device that takes Direct Current

(DC) and converts it to Alternating Current (AC). This means that the DC current from the solar array is sent through an inverter, which transforms it to AC for solar energy systems [5]. To operate most electric devices or connect to the electrical grid this conversion is required. Inverters are essential for practically all solar energy systems and after the solar panels is usually the most expensive component.

The majority of inverters have conversion efficiency of 90% or greater as well as crucial safety features such as ground fault circuit interruption and anti-islanding.

Racking

The mounting gear that secures the solar array to the ground or rooftop is referred to as racking. These devices, which are usually made of steel or aluminium, mechanically fix the solar panels in place with a high level of precision. Extreme weather events such as hurricane or tornado-force winds accumulations should be designed into racking systems. To avoid electrocution, racking systems must also electrically link and ground the solar array. Flat roof racking systems and pitched roof racking systems are the two most common types of rooftop racking systems. For flat rooftops, weighted ballast is commonly used in the racking mechanism to hold the array to the roof utilizing gravity. The racking system must be mechanically anchored to the roof structure on sloped rooftops. Ballast or mechanical anchors are be used to secure the array to the ground in ground-mounted PV systems. Some ground-mounted racking systems include tracking systems that employ motors and sensors to monitor the Sun as it moves across the sky, boosting the amount of energy generated at the expense of greater equipment and maintenance costs.

Combiners, disconnects, breakers, meters, and wire are the remaining components of a conventional solar PV system. As the name implies, a solar combiner combines two or more electrical wires into one bigger one. Combiners are used on all medium to large and utility-scale solar arrays and they often feature fuses for protection.

CONCLUSION

Disconnects are electrical gates or switches that allow an electrical wire to be manually disconnected. These devices, known as the “DC disconnects” and “AC disconnect,” are typically used on either side of an inverter to provide electrical isolation when the inverter needs to be installed or removed. Overcurrent or surge protection is provided by circuit breakers or breakers. Breakers are designed to automatically activate when the current reaches a certain level, but they can also be operated manually to serve as an extra disconnect. Electric utility companies often employ electric meters to monitor and bill consumers because they measure the quantity of energy that travels through them. A specific bi-directional electric meter is used for solar PV systems to monitor both incoming energy from the utility and outgoing energy from the solar PV system. Finally, the wiring or electrical cables must be correctly sized to carry the current and convey electrical energy from and between each component. Wiring that is exposed to the sun must be UV-protected, and wires carrying DC current may require metal sheathing for further protection.

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