

CUSTOM DISTRIBUTION SOLUTIONS FOR SOLAR

WHAT IS SOLAR POWER?

Solar power is the generation of electricity from sunlight. This can be direct as with photovoltaics (PV), or indirect as with concentrating solar power (CSP), where the sun's energy is focused to boil water which is then used to provide power.



to boil water which is then used to provide power.

PHOTOVOLTAIC TECHNOLOGY

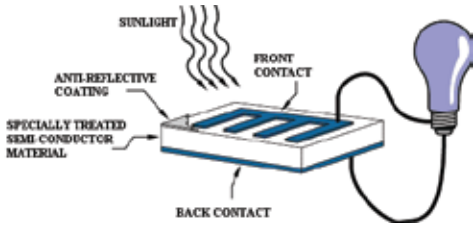
Photovoltaics is the direct conversion of light into electricity at the atomic level. Some materials exhibit a property known as the photoelectric effect that causes them to absorb photons of light and release electrons. When these free electrons are captured, an electric current results that can be used as electricity.

The first photovoltaic module was built by Bell Laboratories in 1954. It was billed as a solar battery and was mostly just a curiosity as it was too expensive to gain widespread use. In the 1960s, the space industry began to make the first serious use of the technology to provide power aboard spacecraft. Through the space programs, the technology advanced, its reliability was established, and the cost

began to decline. During the energy crisis in the 1970s, photovoltaic technology gained recognition as a source of power for non-space applications.

The diagram below left illustrates the operation of a basic photovoltaic cell, also called a solar cell. Solar cells are made of the same kinds of semiconductor materials, such as silicon, used in the microelectronics industry. For solar cells, a thin semiconductor wafer is specially treated to form an electric field, positive on one side and negative on the other. When light energy strikes the solar cell, electrons are knocked loose from the atoms in the semiconductor material. If electrical conductors are attached to the positive and negative sides, forming an electrical circuit, the electrons can be captured in the form of an electric current – that is, electricity. This electricity can then be used to power a load, such as a light or a tool.

A number of solar cells electrically connected to each other and mounted in a support structure or frame is called a photovoltaic module. Modules are designed to supply electricity at a certain voltage, such as a common 12 volts system. The current produced is directly dependent on how much light strikes the module.



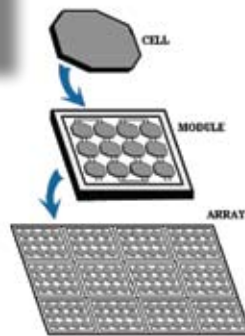
MARELCO SOLAR POWER COMPONENTS MEET ARRA SECTION 1605 REQUIREMENTS



CUSTOM DISTRIBUTION SOLUTIONS FOR SOLAR

Multiple modules can be wired together to form an array. In general, the larger the area of a module or array, the more electricity that will be produced. Photovoltaic modules and arrays produce direct-current (dc) electricity. They can be connected in both series

and parallel electrical arrangements to produce any required voltage and current combination.



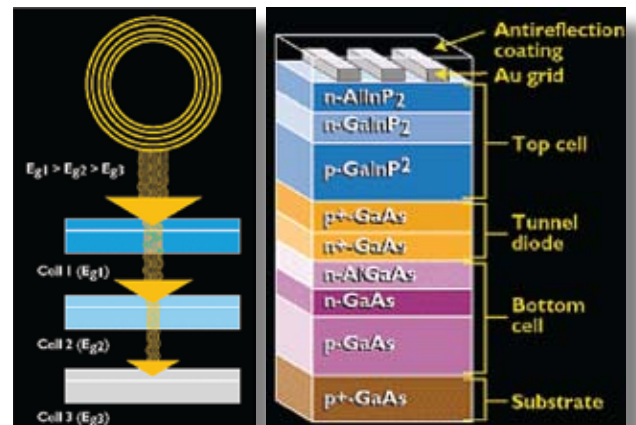
One way to get around this limitation is to use two (or more) different cells, with more than one band gap and more than one junction, to generate a voltage. These are referred to as “multijunction” cells (also called “cascade” or “tandem” cells).

Multijunction devices can achieve a higher total conversion efficiency because they can convert more of the energy spectrum of light to electricity.

As shown below, a multijunction device is a stack of individual single-junction cells in descending order of band gap (E_g). The top cell captures the high-energy photons and passes the rest of the photons on to be absorbed by lower-band-gap cells.

APPLYING PHOTOVOLTAIC TECHNOLOGY

Today’s most common PV devices use a single junction, or interface, to create an electric field within a semiconductor such as a PV cell. In a single-junction PV cell, only photons whose energy is equal to or greater than the band gap of the cell material can free an electron for an electric circuit. In other words, the photovoltaic response of singlejunction cells is limited to the portion of the sun’s spectrum whose energy is above the band gap of the absorbing material, and lower-energy photons are not used.



MARELCO SOLAR POWER COMPONENTS MEET ARRA SECTION 1605 REQUIREMENTS



Marelco Power Systems, Inc. | 327 Catrell Drive | Howell, MI 48843
517.546.6330 | 517.546.9565 fax | web site: www.marelco.com

