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Photovoltaic energy is the conversion of sunlight into electricity through a photovoltaic (PVs) cell, commonly called a solar cell. A photovoltaic cell is a non mechanical device usually made from silicon alloys.

Sunlight is composed of photons, or particles of solar energy. These photons contain various amounts of energy corresponding to the different wavelengths of the solar spectrum. When photons strike a photovoltaic cell, they may be reflected, pass right through, or be absorbed. Only the absorbed photons provide energy to generate electricity. When enough sunlight (energy) is absorbed by the material (a semiconductor), electrons are dislodged from the material's atoms. Special treatment of the material surface during manufacturing makes the front surface of the cell more receptive to free electrons, so the electrons naturally migrate to the surface. When the electrons leave their position, holes are formed. When many electrons, each carrying a negative charge, travel toward the front surface of the cell, the resulting imbalance of charge between the cell's front and back surfaces creates a voltage potential like the negative and positive terminals of a battery. When the two surfaces are connected through an external load, electricity flows.

The photovoltaic cell is the basic building block of a PV system. Individual cells can vary in size from about 1 cm (1/2 inch) to about 10 cm (4 inches) across. However, one cell only produces 1 or 2 watts, which isn't enough power for most applications. To increase power output, cells are electrically connected into a packaged weather-tight module. Modules can be further connected to form an array. The term array refers to the entire generating plant, whether it is made up of one or several thousand modules. As many modules as needed can be connected to form the array size (power output) needed.

The performance of a photovoltaic array is dependent upon sunlight. Climate conditions (e.g., clouds, fog) have a significant effect on the amount of solar energy received by a PV array and, in turn, its performance. Most current technology photovoltaic modules are about 10 percent efficient in converting sunlight with further research being conducted to raise this efficiency to 20 percent.

The pv cell was discovered in 1954 by Bell Telephone researchers examining the sensitivity of a properly prepared silicon wafer to sunlight. Beginning in the late 1950s, pvs were used to power U.S. space satellites. The success of PVs in space generated commercial

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applications for pv technology. The simplest photovoltaic systems power many of the small calculators and wrist watches used everyday. More complicated systems provide electricity to pump water, power communications equipment, and even provide electricity to our homes.

Photovoltaic conversion is useful for several reasons. Conversion from sunlight to electricity is direct, so that bulky mechanical generator systems are unnecessary. The modular characteristic of photovoltaic energy allows arrays to be installed quickly and in any size required or allowed.

Also, the environmental impact of a photovoltaic system is minimal, requiring no water for system cooling and generating no by-products. Photovoltaic cells, like batteries, generate direct current (DC) which is generally used for small loads (electronic equipment). When DC from photovoltaic cells is used for commercial applications or sold to electric utilities using the electric grid, it must be converted to alternating current (AC) using inverters, solid state devices that convert DC power to AC. Historically, pvs have been used at remote sites to provide electricity. However, a market for distributed generation from PVs may be developing with the unbundling of transmission and distribution costs due to electric deregulation. The installations of numerous small scale generators in electric distribution feeders could improve the economics and reliability of the distribution system.