

CHAPTER 5

PV Modules



A solar photovoltaic system has many components. Perhaps the most important component is the PV modules because they are the part of the system that produces the electricity that is supplied to a building or to the electric utility grid. It is very important for a PV system installer to understand how electricity is produced by a PV module and the differences among the various types of PV modules available in today's marketplace. This chapter takes a detailed look at the performance characteristics of PV modules, including how to analyze a module's I-V curve. The effects of temperature and shading on PV modules are also discussed.

Glossary of Terms

amorphous Having no definite form or distinct shape.

cell The basic unit of a PV module; modules are made up of several cells wired in a series or parallel configuration to deliver a desired voltage and current.

diode A semiconductor device that allows current to pass through in only one direction.

doping The process of adding impurities to silicon that results in changes to the silicon's electrical properties.

flat-plate The most common design of PV modules.

maximum power point (MPP) Indicates the maximum output of the module and is the result of the maximum voltage (V_{mp}) multiplied by the maximum current (I_{mp}).

multicrystalline silicon A module type where the solar cells are made of variously oriented individual crystals.

open circuit voltage (Voc) The maximum voltage when no current is being drawn from the module.

photovoltaic effect The process of making electricity in a PV cell.

ribbon silicon A module type where the cells are made from continuous multicrystalline strips.

semiconductor A material that can be either an insulator or a conductor, depending in large part on the temperature of the material.

short circuit current (Isc) The maximum current output of a module under conditions of a circuit with no resistance (short circuit).

Objectives

Upon completion of this chapter, the student should be able to

- Demonstrate an understanding of how electricity is produced by a photovoltaic cell.
- Demonstrate an understanding of what a PV module is made of.
- Demonstrate an understanding of the differences among single crystalline, multi-crystalline, and thin-film types of silicon PV modules.
- Recognize the differences among PV cells, modules, panels, and arrays.
- Analyze the I-V curve of a PV module.
- Demonstrate an understanding of the effects that temperature and shading have on the performance of a PV module.
- Demonstrate an understanding of the common testing standards for PV modules.