

Photovoltaics

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Photovoltaics (or PV)

- PV is the direct conversion of sunlight to DC electricity using a semiconductor effect—there are no moving parts.
- PV cells—the basic building block—are made from either silicon (single-crystal, polycrystalline, and amorphous), cadmium-tellurium, or alloys of copper indium selenium.
- Single-crystal and polycrystalline silicon modules are the most common worldwide, followed by amorphous silicon. Cadmium tellurium and copper indium selenium modules are being introduced.
- PV cells are interconnected to increase the output voltage and current. The PV cells are packaged into a PV module to protect the cells from water, humidity, physical damage, and to provide electrical safety.



Single-crystal silicon PV cell shown above.



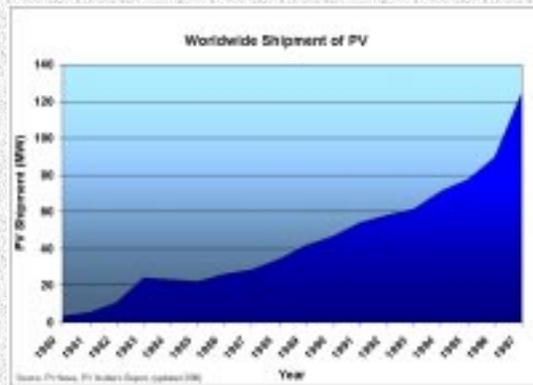
PV cells are series-interconnected in a PV module.

PV is Modular and Reliable

- International standards cover module power ratings and reliability. Many companies offer 10 - 20 year warranties on their modules.
- Modules can be mounted on the ground, on roofs, on poles, or on floats on lakes. Modules can be interconnected for higher voltages or currents. Most modules are made for charging a 12-volt lead-acid battery.
- PV systems can power DC equipment or, with an inverter, AC equipment. PV systems can be used in hybrid systems with wind turbines or generators.

PV Economics

- Module prices are US\$4.50 - \$6.00/W for all PV technologies. The price in other countries will depend on quantity, available supply, taxes, tariffs, and shipping.
- The solar resource and electrical loads are the primary factors in determining the size, and hence cost, of a PV system. Reducing electrical loads will result in lower cost PV systems.
- International reliability standards include testing for wind loading, hail impact, thermal cycling, and electrical isolation. Modules that meet the standards will last longer in the field, resulting in a lower system life-cycle cost.



Worldwide PV shipments continue to increase.



PV modules generally range in size from 50 W to 130 W and can be installed by one to two people. Several modules can be interconnected for more power.