



# Solar Photovoltaics

## Photovoltaics

Photovoltaics (PV) technology converts sunlight into electricity and is also known as solar electricity. The most common solar cell material is crystalline silicon, but newer materials for making solar cells include thin-film materials such as cadmium telluride, copper indium diselenide, and amorphous silicon. More recently, companies have announced plans to produce solar cells using polymer plastics and solar absorbing inks printed on aluminum foil.

Solar cells power everything from small calculators and remote highway signs to commercial buildings and large power plants. They also power our satellites in space, making them responsible for the world's communications products.

### Why Solar PV?

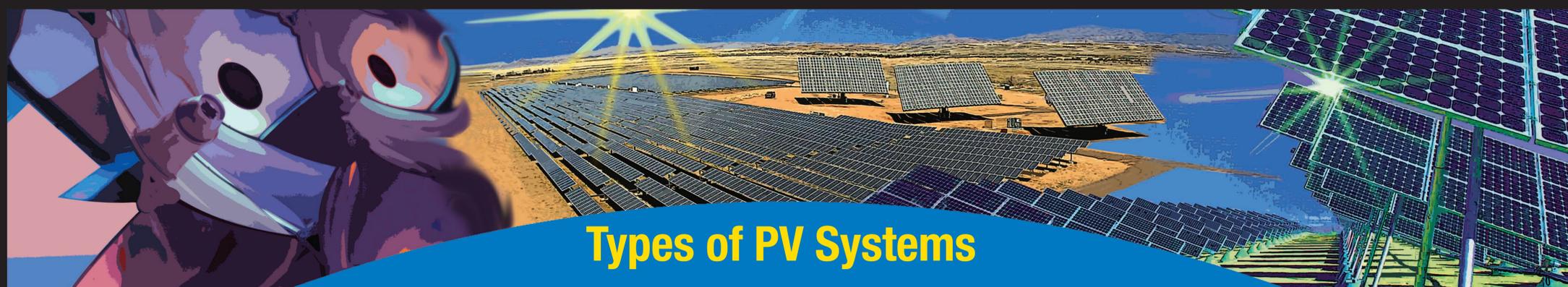
- Clean power from domestic renewable energy
- Reliable solar power
- Easier to build than conventional power plants
- Boosts national economy by creating many new solar companies and jobs.

### PV Power Plants

Although many PV power stations have been built in Europe, only in the last few years have PV power stations begun to be built in the United States. A 14.2-MW PV power station was recently completed at Nellis Air Force Base in Nevada and went on-grid in 2007. Several large concentrator PV power stations have been constructed in the desert Southwest.

EERE Information Center  
 1-877-EERE-INF (1-877-337-3463)  
[www.eere.energy.gov](http://www.eere.energy.gov)

Solar Energy Technologies Program  
[www.eere.energy.gov/solar](http://www.eere.energy.gov/solar)



## Types of PV Systems

### Flat-Plate (Fixed and Single-Axis Systems)



This 14.2-MW PV power plant at Nellis Air Force Base, Nevada, is one of the largest solar power plants in the world using flat-plate PV technology.



This 540-kilowatt flat-plate PV system installed at the Cal Expo in Sacramento, California, produces enough energy to power about 180 homes and provides shading for some 1,000 vehicles.

### Concentrator PV (Dual-Axis Systems)



The SolFocus CPV system shown above is mounted on a dual-axis tracker that maintains the alignment of the optics with the sun.

## Key Environmental Topics

**Energy Payback (Input vs. Output)** – A PV module pays for itself in terms of energy in a few years (1-5 years). With life expectancies of 30 years, 87% to 97% of the energy produced by a PV system will be free of pollution and greenhouse gas emissions. Concentrator PV energy payback is estimated at 8 months in a site having a good solar resource because they use more common materials such as steel and plastic and their production plant costs are low.

**Greenhouse Gas Mitigation** – Life-cycle greenhouse gas emissions range from about 25-32 g/kWh and are expected to decrease to 15 g/kWh in the future. (A coal-fired power plant emits some 915 g/kWh.) Using renewable power for manufacturing and transportation could drop emissions to close to zero.

**Toxic Emissions/Waste** – The amount of toxic substances used to make some types of solar panels is relatively small. With proper emissions control, the emissions from module production can be almost zero. Manufacturers of PV modules now offer to recycle modules for customers, resolving many environmental concerns.

**Land Use** – PV power stations located in the desert Southwest use relatively small amounts of land. They also provide shading for wildlife. Utility-scale PV systems can also be placed over existing land used for parking lots and commercial buildings.

**Health & Safety** – Workers' exposure to toxic substances in manufacturing facilities is controlled by rigorous industrial hygiene practices and is continuously monitored by medical tests, thus preventing health risks.