

SOLAR POWER APPLICATIONS

Concentrating Solar Power (CSP): Concentrating solar power (CSP) plants are utility-scale generators that produce electricity using mirrors or lenses to efficiently concentrate the sun's energy. The four principal CSP technologies are parabolic troughs, dish-Stirling engine systems, central receivers, and concentrating photovoltaic systems (CPV).

Solar Thermal Electric Power Plants: Solar thermal energy involves harnessing solar power for practical applications from solar heating to electrical power generation. Solar thermal collectors, such as solar hot water panels, are commonly used to generate solar hot water for domestic and light industrial applications. This energy system is also used in architecture and building design to control heating and ventilation in both active solar and passive solar designs.

Photovoltaics: Photovoltaic or PV technology employs solar cells or solar photovoltaic arrays to convert energy from the sun into electricity. Solar cells produce direct current electricity from the sun's rays, which can be used to power equipment or to recharge batteries. Many pocket calculators incorporate a single solar cell, but for larger applications, cells are generally grouped together to form PV modules that are in turn arranged in solar arrays. Solar arrays can be used to

power orbiting satellites and other spacecraft, and in remote areas as a source of power for roadside emergency telephones, remote sensing, and cathodic protection of pipelines.

Solar Heating Systems: Solar hot water systems use sunlight to heat water. The systems are composed of solar thermal collectors and a storage tank, and they may be active, passive or batch systems.

Passive Solar Energy: It concerns building design to maintain its environment at a comfortable temperature through the sun's daily and annual cycles. It can be done by (1) Direct gain or the positioning of windows, skylights, and shutters to control the amount of direct solar radiation reaching the interior and warming the air and surfaces within a building; (2) Indirect gain in which solar radiation is captured by a part of the building envelope and then transmitted indirectly to the building through conduction and convection; and (3) Isolated gain which involves passively capturing solar heat and then moving it passively into or out of the building via a liquid or air directly or using a thermal store. Sunspaces, greenhouses, and solar closets are alternative ways of capturing isolated heat gain from which warmed air can be taken.

Solar Lighting: Also known as daylighting, this is the use of natural light to provide illumination to offset energy use in electric lighting systems and reduce the

cooling load on HVAC systems. Daylighting features include building orientation, window orientation, exterior shading, saw tooth roofs, clerestory windows, light shelves, skylights, and light tubes. Architectural trends increasingly recognize daylighting as a cornerstone of sustainable design.

Solar Cars: A solar car is an electric vehicle powered by energy obtained from solar panels on the surface of the car which convert the sun's energy directly into electrical energy. Solar cars are not currently a practical form of transportation. Although they can operate for limited distances without sun, the solar cells are generally very fragile. Development teams have focused their efforts on optimizing the efficiency of the vehicle, but many have only enough room for one or two people.

Solar Power Satellite: A solar power satellite (SPS) is a proposed satellite built in high Earth orbit that uses microwave power transmission to beam solar power to a very large antenna on Earth where it can be used in place of conventional power sources. The advantage of placing the solar collectors in space is the unobstructed view of the sun, unaffected by the day/night cycle, weather, or seasons. However, the costs of construction are very high, and SPSs will not be able to compete with conventional sources unless low launch costs can be achieved or unless a space-

based manufacturing industry develops and they can be built in orbit from off-earth materials.

Solar Updraft Tower: A solar updraft tower is a proposed type of renewable-energy power plant. Air is heated in a very large circular greenhouse-like structure, and the resulting convection causes the air to rise and escape through a tall tower. The moving air drives turbines, which produce electricity. There are no solar updraft towers in operation at present. A research prototype operated in Spain in the 1980s, and EnviroMission is proposing to construct a full-scale power station using this technology in Australia.

Renewable Solar Power Systems with Regenerative Fuel Cell Systems: NASA has long recognized the unique advantages of regenerative fuel cell (RFC) systems to provide energy storage for solar power systems in space. RFC systems are uniquely qualified to provide the necessary energy storage for solar surface power systems on the moon or Mars during long periods of darkness, i.e. during the 14-day lunar night or the 12-hour Martian night. The nature of the RFC and its inherent design flexibility enables it to effectively meet the requirements of space missions.

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