

Fact Sheet-- Renewable Energy

Off-Grid Solar Electricity

Description

PhotoVoltaic (PV) cells consist of semi-conducting material that absorbs sunlight. The solar energy excites electrons within the material, freeing them of their atoms and allowing them to flow and create electricity.

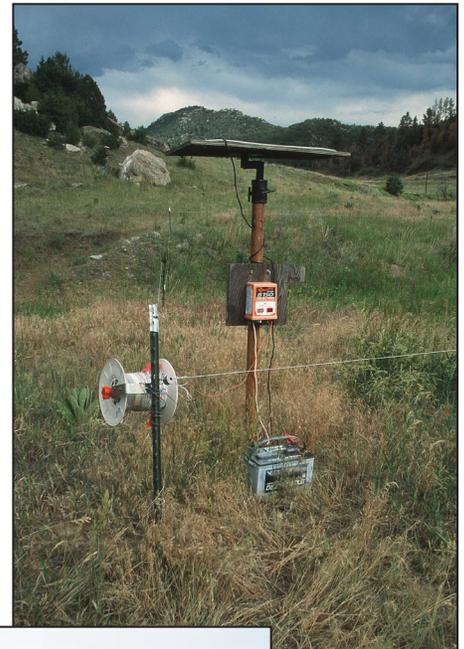
PV in Remote Locations

Solar electric systems (PVs) are becoming more popular in remote sites where extending a line from the existing power grid may be cost-prohibitive. For this reason, pumping water for livestock and powering electric fences are popular uses.

Electric fences are typically 4-6 or 12-24 volt systems. One 2-ft square solar panel and battery storage may be sufficient to run these systems. Kits are commercially available.

One solar panel may generate up to 50 watts of power, depending on the latitude and available solar radiation on any given day. For example, more sun rays are available in Texas than Michigan, making PV systems in Texas more cost-effective.

Using PV cells to power pumps requires more planning. Remote sites have traditionally used diesel, propane, or gas engines for pumping water. To consider a solar electric conversion, one needs to calculate how many watts or horsepower (HP) are needed to run the pump.



Solar panels provide power for electric fences and livestock watering systems.

PV in Hybrid Power Systems

To install a PV system, you must first determine how much power is really needed. Perhaps the pumping system only uses 80 hp of a 100 hp pump. Once the power load is determined, one can compute how many solar panels it takes

to power the system.

A 100 hp system is equal to 74,800 watts. The expense of converting to a 100 hp system of PVs may be exorbitant, although prices are going down and PV efficiencies are going up. A panel may produce only 30-50 watts, but by pumping all day, will produce enough to satisfy a thirsty herd of cattle.

Another approach may be to install a limited number of solar panels for smaller applications such as electric fencing. The panels can also be used as a supplemental power source for pumping water.

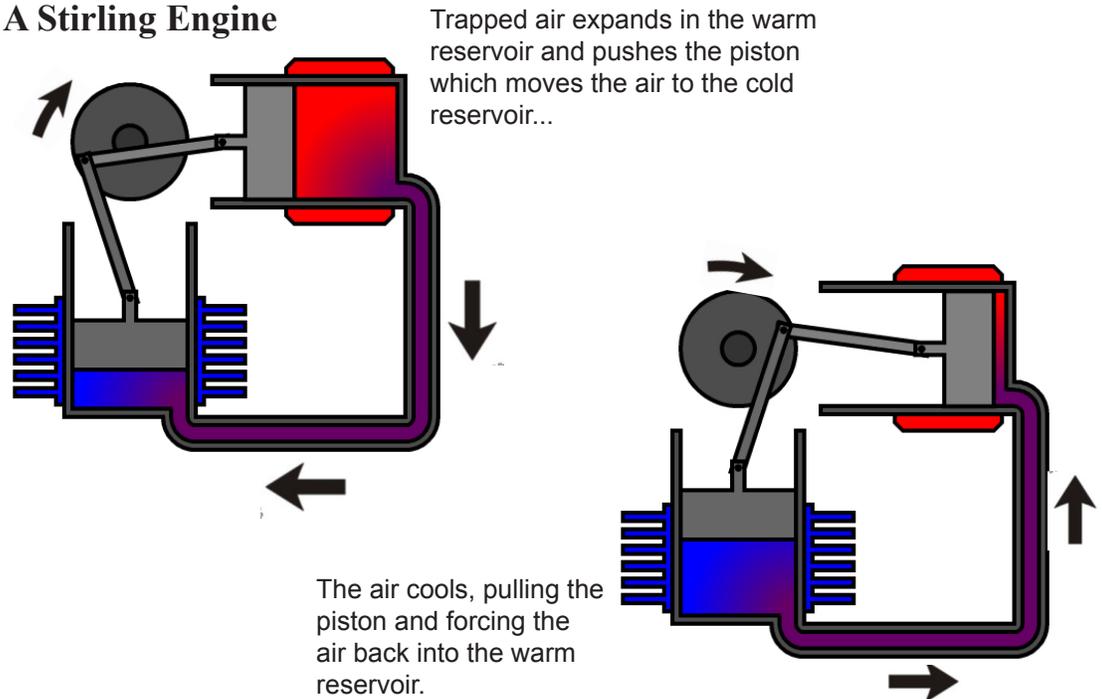
Stirling Engine

An emerging solar technology involves the use of a Stirling engine. Stirling engines have existed for more than 100 years but have recently resurfaced for use with solar energy systems.

Stirling engines are noted for their high efficiency, quiet operation, and the ease with which they can utilize what would otherwise be wasted heat. They convert heat directly to mechanical energy. In the hot reservoir, the air expands and pushes a piston that moves the air to the cold reservoir. There the air contracts and pulls the power piston, completing the cycle. The system operates using the increased pressure of gases heated by the sun as a power source. The efficiency of the Stirling engine is said to be twice that of PVs.

Southern California Edison is currently building a 500 mega-watt solar-generating plant in the Mojave Desert that will use this technology. It will be the largest such plant in the world.

A Stirling Engine



For More Information

For more information on ethanol or renewable energy, contact the Energy National Technology Development Team at the West National Technology Support Center in Portland, OR, Stefanie Aschmann, Team leader, 503-273-2408, stefanie.aschmann@por.usda.gov.