Solar power charges an electric fence on this Colorado ranch.
Photo: Warren Gretz, National Renewable Energy Lab

Remote Electricity Supply

Sunlight can also generate electricity. Photovoltaic (PV) panels are often a cheaper option than new electric lines for providing power to remote locations. And because they require no fuel and have no moving parts, they are more convenient to operate and maintain than diesel or gasoline generators. In some areas, the distance from a power source at which PV becomes more economical than new transformers and electric lines is surprisingly short — often as little as 50 feet.

PV systems are a highly reliable and low maintenance option for electric fences, lights, and water pumps. Although current prices for solar panels make them too expensive for most crop irrigation systems, photovoltaics are economical for remote livestock water supply, pond aeration, and small irrigation systems. In addition, the cost of PV is projected to decline significantly over time, which will make more applications cost-effective.

For more information —

Centre for the Analysis and Dissemination of Demonstrated Energy Technologies
www.caddet-re.org

Cooperative Extension Publications
630 West Mifflin Street, Room 170
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Midwest Plan Service
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217-333-7964
www.mwpshq.org

National Renewable Energy Laboratory
Renewable Resource Data Center
1617 Cole Boulevard
Golden, CO 80401
303-384-6979
rredc.nrel.gov

PV Design Assistance Center
Sandia National Laboratory
Albuquerque, NM 87185-0753
505-844-3698
www.sandia.gov/pv/pvsys/pvsac.htm

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To find out more about renewable energy and agriculture, visit the UCS web page at www.ucsusa.org/energy. Or write: Energy Program, Union of Concerned Scientists, Two Brattle Square, Cambridge, MA 02238. Or call: 617-547-5552.

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FACT SHEET

Up with the Sun: Solar Energy and Agriculture

Solar energy, power from the sun, is clean and unlimited. Capturing the sun's energy for light, heat, hot water, and electricity can be a convenient way to save money. Whether drying crops, heating buildings, or powering a water pump, using the sun can make the farm more efficient.

The amount of energy that reaches the earth from the sun each day is enormous. All the energy stored in the earth's reserves of coal, oil, and natural gas is equal to the energy from only 20 days of sunshine. While desert areas such as Arizona and Nevada get more sun than other parts of the United States, most areas receive enough sunshine to make solar energy practical.

Putting the Sun to Work on the Farm

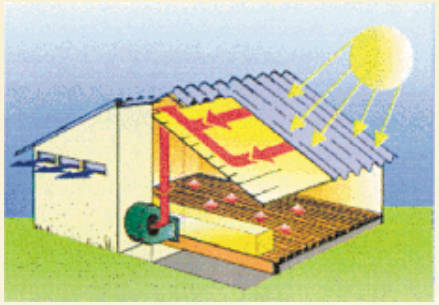
Solar energy can be used in agriculture in a number of ways, saving money, increasing self-reliance, and reducing pollution.

Solar power controls this irrigation system.
Photo: Siemens Solar Industries, NREL

Solar Light and Heat

One of the simplest ways to use solar energy is to design or renovate buildings and barns to use natural daylight, instead of electric lights. Dairy operations using "long day" lighting to increase production can save money with skylights and other sun-lighting options.

The sun's heat can also be used to warm homes and livestock buildings. In confinement operations, a steady supply of fresh air is critical to maintaining animal health, but this can result in substantial heating bills. "Active" solar heating systems, which use heat boxes and fans, can warm the air, saving on fuel. "Passive" solar designs, where the building is designed to take advantage of the sun automatically, are often the most cost-effective approach.



This solar barn dries hay while saving money.
Source: Centre for the Analysis and Dissemination of Demonstrated Energy Technologies

Solar water heaters can provide low- to medium-temperature hot water for pen cleaning. Dairy operations can use solar heated water to clean equipment and to warm and stimulate cows' udders. For homes or farms with electric or propane water heaters, solar collectors can save hundreds of dollars per year.

Crop and Grain Drying

Using the sun to dry crops and grain is one of the oldest applications of solar energy. Solar drying equipment can dry crops faster and more evenly than leaving them in the field after harvest, with the added advantage of avoiding damage by birds, pests, and weather.

A typical solar dryer consists of an enclosure or shed, screened drying trays or racks, and a solar collector. In a simple design, south-facing windows let sun into the shed. Other designs use a dark colored box with a glass cover to capture the heat. Natural convection or a fan moves hot air through the crops to dry them.

While the cost of a solar collector can be high, using the collector to heat other buildings at other times of the year makes it more cost-effective. And small, low-cost dryers are easy to make out of simple materials.

At one installation in Switzerland, a farmer added a dark metal roof to a hay barn to serve as a solar collector, with a fan to draw the hot air through the barn. This eliminated the need for an oil or electric heater, saving $4,100 per year in reduced energy and maintenance costs. Moreover, since the farmer did the work himself, the up-front cost was only an eighth of what an oil heater system would have cost.

If a farm has a crop dryer already in place, it may make sense to install a low-cost solar heater to supplement a propane or oil heater. The farmer would save on fuel costs while still being able to dry crops in cloudy weather.

Greenhouse Heating

Commercial greenhouses often rely on the sun for lighting, but on gas or oil heaters to maintain constant temperatures. A solar greenhouse uses building materials to collect and store solar energy as heat. Insulation retains the heat for use during the night and on cloudy days. To capture the most sunlight, a solar greenhouse generally faces south, while its northern side is well insulated, with few or no windows. A gas or oil heater may be used as a backup.

The sun is a reliable source of heat, light, and power for greenhouses.
Photo: Warren Gretz, National Renewable Energy Lab

Badgersett Research Farm Solar Greenhouse

Philip and Mary Rutter built a solar greenhouse on their farm in Canton, Minnesota. The greenhouse is partially earth-sheltered, because of the cold growing area, and the roof is superinsulated with glass facing only south. Six photovoltaic panels and a small wind turbine provide power for lighting, fans, water pumping, and opening and closing large insulating shutters. No backup heating system or power source is needed. Extending power lines to the greenhouse would have required dedicating a substantial amount of land to the power company, clearing trees, and losing the productive potential of the land.

The total cost of the system was $5,600, which is higher than standard greenhouses of the same size. But the Rutters estimate that the system will pay for itself in ten years through energy savings. By financing the system as part of their mortgage and depreciating it as business equipment, they have also gained significant tax benefits.

"It works!" Philip Rutter says. "So far this year we've grown about 20,000 plants in here, which is actually a small fraction of what we expect the building to be able to produce. This is not a far-out alternative kind of building. This is a very straightforward money-making operation." In addition to saving money on energy bills, "the energy is substantially more reliable," Rutter says. "In a traditional, above-ground greenhouse, if you have a heating system failure in the winter, you can lose your crop in a hurry. Unless the roof blows off, which is really not possible, this building can't freeze in the wintertime because of its earth-sheltered and superinsulated aspects. That security may make the difference between whether our business survives in the long term."

Source: *Solar Living Source Book: The Complete Guide to Renewable Energy Technologies and Sustainable Living,* Real Goods, Ninth Edition,1996.

Background Photo: Rick Hinrichs