

Solar Energy just around the corner

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Editor's Note: This article gives a good idea of what is happening in solar energy. IAPMO's solar energy committee is on top of the issue.

The technical know-how exists to convert the nation to solar energy for heat and power. But the cost is still prohibitive.

TUCSON, Ariz. (AP) — Little by little, Americans are turning on to solar power, tapping the strength of Earth's sun to do the work of man.

Solar energy is only in its infancy, but already sunlight is heating, cooling or doing both for more than 200 U. S. homes and a dozen or more office buildings, mostly in the sunny Southwest.

Sunshine machines are now heating swimming pools, operating a few highway construction warning lights, powering a handful of buoys on lonely waterways, and electrifying a remote U. S. Park Service restroom in Yellowstone National Park.

A university professor in Tucson, Ariz., cooked a Thanksgiving turkey in a solar oven of his own design. Since the 1940s, a Florida company has been installing rooftop solar heat collectors, at a cost of up to \$1,500 a unit, to heat water in homes. The sun

both warms and cools an Atlanta school, a New Hampshire federal office building, a Texas college dormitory and a New Mexico laboratory.

Solar units are now under construction, or in the advance planning stage, to broil hamburgers in a New Jersey fastfood restaurant, operate a sewage treatment plant in Wilton, Maine, dry grain for Iowa framers and generate electricity for Bridgeport, Tex., a small town.

Experts say all signs point to the birth of a solar energy industry. Recently, the federal government conducted a survey to determine private industry's interest in solar research. There were more than 200 replies from companies, large and small. Right now, at least 23 companies are selling solar heat collector panels to heat and cool homes or to heat water. The glass and metal panels cost from \$100 to more than \$500 each, and a three or four bedroom home usually requires a dozen or more. They look like sandwiches or very narrow flower boxes three to six feet in depth, eight to ten feet long and four to eight inches thick. They usually are placed on rooftops.

Nobody knows exactly how many have been sold, but one expert, in a "very rough estimate,"

said it is "no more than a few million dollars worth this year."

"It's difficult to give a good number," said Dr. Lauren VanHull, associate director of the University of Houston's Solar Energy Research Lab. "Solar panels are something you can build yourself."

Many are turned out as custom jobs in machine shops or as part of the design for a specific house or office building.

Arthur D. Little Inc., a research firm, estimates that solar power equipment will be a \$1.3 billion industry by 1985 and more than a million homes will be plugged into sunlight for heat, air conditioning, or to generate electricity. But less than \$60 million was spent in 1975 on solar energy, an Associated Press survey indicates, and most of that was federal funds.

Despite the incredible promise of solar energy, and the technology to use it, the economics of sun power is a major obstacle. So far, solar energy systems are more expensive than fossil fuel systems.

The federal Energy Research and Development Agency (ERDA) has a program designed to demon-

strate and test equipment for heating and cooling. The agency is funding demonstrations of systems developed by private companies and is making technical assessments of equipments under development. ERDA also is funding research into advanced solar electric-generating systems. Private companies, universities and other government agencies are performing this research.

ERDA spent \$48.5 million last year on more than 20 solar projects. It is asking Congress for \$70 million for solar energy demonstrations this year in 2,400 homes and 200 commercial buildings in 12 different U. S. climates.

Tapping the power of the sun has caught the fancy of hundreds of individual inventors, according to experts who receive queries from every state. Some backyard tinkerers are developing or trying to develop new techniques to tap the sun, while others are using ways as ancient as the adobe wall to capture the might of the endless sunshine that drenches our planet.

In some neighborhoods, sun power systems are becoming prestige ways of keeping ahead of the Joneses, says Dr. Robert C. Cass, a University of Houston environmental psychologist. People who

once took pride in having the first color television set or the first swimming pool on the block, are now installing sunshine energy systems.

"Don't be surprised," says Dr. Cass, "if you start seeing fake solar panels show up on homes. It could become that type of thing."

The Massachusetts Electric Co. recently asked for volunteers to invest \$200 each in experimental solar energy panels for their homes. One hundred homeowners were sought, but 5,000 applied and the company was forced to hold a public drawing.

Engineers and scientists say that solar energy on a wide scale is now technically possible. Our know-how, they say, even includes ways to fire industries with sunshine sponges and to fuel cars with hydrogen harvested with solar heat.

The amount of energy spewed out by the sun is immense. Experts estimate that the sun showers the earth with 800 trillion kilowatts of energy hourly, about 100 times more energy each hour than man has used throughout history.

But even for relatively easy jobs, such as water and space heating, sun power is costly, mostly because of the large storage units that are necessary to keep a solar system running when the sun isn't out.

In Tucson, which has one of the nation's best climates for the use of solar energy, builder Ernest Carreon estimates that a sun-power heating system in a three or four bedroom home adds roughly a \$5 per square foot to the cost of the house. Carreon built a 1,200 square foot home with a solar system. The cost was \$45,000. He said it would have been \$39,000 or \$40,000 with a conventional heating system.

"The solar system will pay for itself (through energy savings) in 11 years at today's electrical rates," says Carreon, "but it would take 62 years at today's natural gas prices."

The cost of installing a solar energy unit to heat and cool a 2,000-square-foot house in Austin, Tex., is about \$12,500, or \$11,000 more than a conventional system burning fossil fuels, says Dr. Gary Vliet, a University of Texas professor.

Much of this cost is in the water storage tanks holding 8,000 to 12,000 gallons, buried and insulated, that are needed to store heat for an average home in a moderate climate for up to three consecutive cloudy, sunless days.

However, Vliet estimates that mass production and other factors could bring cost down to \$8,600

within three years.

"Right now, about the only people who can afford solar energy are those who want to do it (build solar-powered systems) themselves," said Dr. Aden Meinal, a University of Arizona scientist and a well-known solar energy expert. "Solar energy collectors aren't hard to make with enough money. In fact, they're very easy to make."

The simplest, and the most commonly used today, are called flat plate collectors. They look like sandwiches three to six feet by eight to ten feet, and they're made of glass, metal and insulation. A clear top layer of glass or plastic allows sunlight to strike a metal panel. The panel, painted black, concentrates the heat. Liquid-filled tubes or moving air carry the heat to a storage system which can be a buried tank of water or a basement full of rock. This system can achieve temperatures of up to 210 degrees even in winter.

Such systems easily provide heat for buildings when air is pumped around the storage unit and back out into rooms. With various adapters, the flat plate collector system also heats water in homes and swimming pools, and operates absorption air conditioners.

"We can build a storage system that would hold heat virtually forever," said James Leonard, head of the Sandia Laboratories in Albuquerque, N.M., which has an ERDA contract. "But cost is the driving factor."

A more difficult job for solar energy is generating electricity. Two methods are being developed, one using collected sun heat and the other direct conversion of sunlight to power, a process called photovoltaics.

The collected sun system uses concentrators that produce temperatures of 1,000 degrees or more with sunlight. Such processes use liquid to move the heat and drive a turbine. They usually are called "liquid transfer" systems.

A concentrator invented by Ronald Winston, a University of Chicago professor, is a trough-shaped mirror with a black-coated pipe along the bottom of the trough. Liquid run through the pipe collects heat.

A similar system is being used by a Sandia Laboratory team, headed by Leonard. Instead of mirrors, the Sandia team is using curved plywood, coated white, to save money. An oil collects and stores the heat. Leonard said the system can collect up to 600 degrees of heat, enough to power steam turbines and others that generate electricity.

The Sandia project's goal is a solar energy system that eventually will generate 32 kilowatts of power and provide heating, cooling and power to a 12,000 square foot laboratory and office building, roughly the size of six two-story homes with four bedrooms apiece.

Another "liquid transfer" system under study has fields of curved mirrors tracking the sun across the sky and reflecting its heat onto a globe atop a tower. Liquid circulated through the globe is heated and returned to a central power generating station.

Photovoltaics, or solar cells, directly convert sunlight to electricity. These cells, actually silicon crystals, powered the Skylab space station and are used in many unmanned spacecraft.

Photovoltaic power is the most costly. The Electric Power Research Institute (EPRI) estimates that a solar cell power plant would cost \$20,000 per kilowatt capacity. This compares with \$600 for a fossil fuel plant with the same capacity and \$1,000 for a nuclear plant.

The cost picture is more favorable compared with nuclear power plants. Dr. A. F. Hildebrandt, director of the University of Houston Solar Energy Lab, which developed the solar tower concept, estimates that power plants using the solar tower could be built for about \$930 per kilowatt, or less than the current cost of nuclear plants.

But heat storage is still a problem for the fluid transfer systems used in electric power generation because temperatures of 600 degrees and more must be stored at night and on cloudy days. Scientists are looking into the use of a variety of liquids, oils, salts and metals with low melting points for use in storage units.

Not all solar powered systems require gadgets and hardware.

Ed Doogan, a Tucson builder, says he and several other builders in Arizona and New Mexico are designing "passive" solar systems for homes.

These employ adobe brick, a cheap building material which has the ability to store heat or coolness. Borrowing techniques developed by Indians 500 years ago, Doogan said builders are designing adobe homes that store heat in the floor and collect coolness during the night in the walls.

Harold R. Hay, an inventor in Atascadero, Calif., designed a house heated and cooled by reservoirs of water installed on a metal roof. In the winter, the water is exposed to the sun and

collects heat that warms the house. In summer, the reservoirs are covered during the day and opened to cool air at night.

Despite the possibilities, widespread use of solar power is limited by the complex factors that influence the nation's energy use. There is cost, investment in existing energy industries, the availability of other fuels, financing, building and construction standards, public acceptance, and even the legal question, "Who owns sunlight?"

ERDA, set up less than two years ago, is attempting to create an interest and a market for solar equipment. This, in turn, could lead to mass manufacturing, which would bring down cost.

The International Association of Plumbing and Mechanical Officials, the American Institute of Architects and other agencies are working on construction and design standards for solar energy systems.

Tax incentive are being used in several states and in some cities to encourage use of solar energy. New Mexico, for example gives tax rebates to help cover the cost of solar installations.

Other states with solar energy tax incentives are Colorado, Indiana, Maryland, Montana, New Hampshire, North Dakota, Oregon, South Dakota and Texas.

A report prepared for New York City says it may be one of the first where solar energy becomes economically attractive because of the high electricity rates there. Despite this, the RCA Corp. recently scrapped a plan to install solar heating and cooling in the 70-story RCA building in New York.

Nevertheless necessity may lure people to solar power, if the experience of Bridgeport, a small Texas town, is any example.

When Bridgeport's 5,000 people refused to pay a rate increase to the Texas Power & Light Co., the utility threatened to cut off the city.

"They said they were going to pull the plug on us so we decided to go shopping for other sources of power" said city councilman Jack Vandeventer.

What they found was SolarKing Inc. The Reno, Nev., firm offered to install a 4.2 million kilowatt power plant operating on sunshine.

The project will have no federal help and Solar King president Brian Pardo calls it "a case of American ingenuity of the common man solving a problem."