Breaking the Solar Energy Logjam

Solar-related energy has been neglected for economic, not technological reasons. New efforts in Congress may help to solve this problem.

by John H. Douglas

America could have had solar energy now—certainly enough to have counteracted the Arab oil embargo; possibly enough to make the Alaska pipeline unnecessary. But we don't have it, and before U.S. industry gears up to meet the challenge of producing solar power through already available technology, a lot more money will flow into the Middle East and more devices will be patented in countries where solar technology has been better encouraged.

If Americans eventually have to import their solar heaters and coolers, portable electric power units and desalinators, we will have no one to blame but ourselves. Commercially feasible ways of using wasted solar energy, based on mature technologies, have languished for lack of imaginative capital investment. Promising technological breakthroughs have lacked sufficient funding for development. And now a long winter's scare over fuel shortages has served to reemphasize the need for diversifying energy resources.

Not that people haven't thought about solar power long enough. Two centuries before Christ, Archimedes reputedly destroyed an attacking Roman fleet by reflecting the sun's heat from many small mirrors. While Galileo was exploring the sun's surface with a special telescope, a Frenchman, Salomon de Caus, was pumping water with a solar engine. A solar-steam engine was the hit of the 1878 Paris World Exposition and spawned a generation of small-scale, practical devices from Egypt to California.

But new ideas, even very good ones, need monentum to succeed. The Egyptian solar-steam engine was abandoned after a labor dispute. Mechanical failures in other devices were not corrected in succeeding models. Most important, cheap and seemingly inexhaustible oil and gas began to fuel the developing industrial revolution. Solar energy again became the province of tinkerers and dreamers, finding practical use only in a few specialized applications.

Now, a new wave of solar consciousness is arising. In place of the dreamers' vision of the sun as a *substitute* source of free, unlimited energy has come a realization of the desperate need for a clean, widely available *additional* energy source. To industrialized countries choking in the residues of fossil fuels and threatened by embargo of economically vital resources, solar energy represents new hope for continued expansion and renewed freedom of action. To underdeveloped countries, falling progressively behind their industrialized neighbors, the democratizing promise of solar power offers what may be their last hope for obtaining the one vital resource that spells the difference between riches and poverty—energy. Blessed in most cases with sunny climates, these countries have been hit hardest by fuel shortages.

Many countries have been faster than the United States in adopting solar energy into their daily life. Of the industrialized countries, Japan, which imports 98 percent of its fuel, has adopted one of the most ambitious programs for integrating solar installations into its economy. Solar water heaters are already being mass produced and are in common use. Through "Project Sunshine," the Japanese Government is encouraging development of large-scale, centralized solar electrical-generation facilities and the use of solar-produced hydrogen as a fuel. It will probably be years before a comparable commitment to such ventures is made in this country. The Soviet Union, with its vast undeveloped territories, has concentrated on introducing solar devices that will help tame the wilderness: a pumpless refrigerator to preserve food, solar-powered sluice gates for remote irrigation ditches, a well pump and a still that for five years has provided herds of sheep with fresh water from brine lying deep beneath a desert.

In developing countries the scale of application has been smaller, the techniques simpler, but often the impact has been greater. Some children in Haiti now have hot lunches because of solar heat. Several million hot water heaters that take their energy from the sun are being used around the world. In Mauritania, on the southern fringe of the Sahara, 3,000 inhabitants of a remote village now get twice the water they previously received because of a solar-energy collecting system located atop the local schoolhouse, an installation that incidentally keeps the school interior 5 degrees C. cooler.

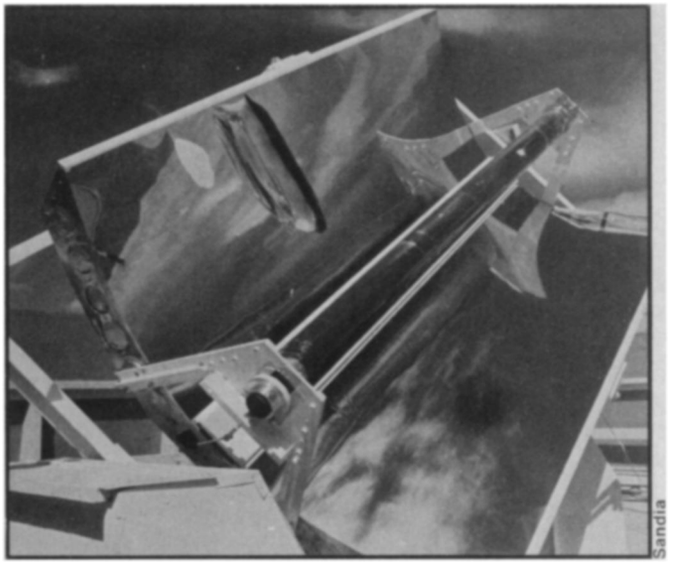
Newfangled NASA "wind converter."

The United States can still play a unique role in developing the new, and sometimes radical applications of solar energy that depend on the highest level of sophisticated technology. By developing special films to coat transparent pipes, American scientists have discovered how to heat molten sodium inside the pipes by selective transmission of energy through the films. In a scheme worked out by the husband and wife team of physicists, Aden and Marjorie Meinel, a network of such pipes would be laid across a portion of the Arizona desert to generate a million megawatts of electricity and desalinate enough water from the Pacific, through its wasted heat, to meet the needs of 120 million people.

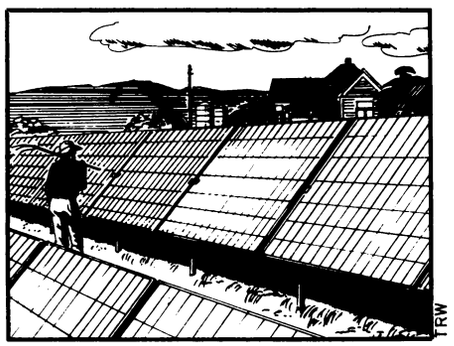
Specialists in the tedious art of growing artificial crystals are exploring the possibility of growing thin ribbons of silicon crystals, possibly a mile long, from which to make inexpensive photocells. Photovoltaics are now limited to such specialized applications as powering artificial satellites and remote ocean buoys, but many vital terrestrial needs await development of such portable, low-power energy sources. Under the plain of the Ganges in India lies enough water to irrigate vast areas of currently parched land, provided there were enough small wells dispersed about the area. But animals that are now used to pump water from such wells often drink a sizable portion of the water they draw up. Small electric pumps powered by solar cells could bring new hope to this and other energetically remote areas, if the cells can be mass-produced cheaply enough.

Technological innovation alone will not be enough to assure development

The first American solar-heated classrooms are in Baltimore.



The focusing solar-heat collector developed by Sandia Labs.



Large-scale solar-energy collection farm.

of a solar age. Past solar achievements have been eclipsed by economic, not technical problems, and current planning must take into account the requirements for commercial success. The solar-induced temperature difference between the ocean's surface and its depths, for example, has long been recognized as a potential source of almost unlimited power. Successful experiments to tap this thermal gradient were conducted early in this century and a practical demonstration plant, generating 22 kilowatts of useful power, was constructed off the coast of Cuba in 1929. But such ventures require large amounts of risk capital and when, as in the case of the Cuban device, mechanical difficulties arise, investors begin to look elsewhere.

To attract investors once again into the solar market, designers are producing increasingly sophisticated package-projects, combining the gathering of solar energy with some other profitable function. Scientists concerned with exploiting oceanic temperature differences are beginning to tie the idea of pumping cold water up from the ocean depths (for heat-transfer purposes) into the idea that such bottom water also contains rich nutrients that could be used to "farm" shellfish. Current estimates show that an $18-million plant could produce freshwater and electricity at competitive prices while surfacing enough sea bottom nutrients to sustain a profitable farming operation. Results from an experimental mariculture installation, using bottom water off St. Croix in the U.S. Virgin Island, projects an annual revenue of $50,000 per acre of farming pond. The clams, oysters and scallops thus produced were rated superior to those grown naturally by a panel of taste experts.

Whether such innovative technologies are ever fully developed and whether currently feasible applications of solar energy ever gain wide public acceptance depends in large part on current Administration initiatives in this area and on the fate of several solar-energy bills now before Congress. Last year, the National Science Foundation and the National Aeronautics and Space Administration issued a joint report recommending a total of $3.52 billion for solar R&D over the next 15 years. Given such a commitment, the report stated, solar energy could be in common use for heating homes within five years, for cooling homes in six to ten years, for producing synthetic fuels in five to eight years and for producing electricity in ten to fifteen years. By the time these recommendations had gone through a review process led by Atomic Energy Commission Chairman Dixy Lee Ray, however, the solar commitment had dropped to $50 million for the coming fiscal year—less than one tenth the amount given the AEC for developing the breeder reactor.

Several Congressmen have accused the Administration of beggaring solar energy and have submitted their own bills to appropriate additional funds. Reasoning that one way to break through the inertia attached to solar innovation would be to encourage the earliest possible public acceptance, the chairman of the House Subcommittee on Energy, Mike McCormack (D-Wash.), introduced a bill to subsidize installation of solar heaters in new houses, beginning with establishment of uniform standards for such installations by the National Bureau of Standards. Other bills combine increased solar R&D funding with various schemes to reorganize the administration of the nation's energy resources.

Only about 20 houses in the United States now have solar heating though several major and minor companies claim the ability to begin mass installation of such units, given proper incentive. The mobile-home industry is reportedly interested in rooftop solar heaters for their products as well as in centralized units for trailer courts. Already solar heating has been included in the plans for three new office buildings: the state Audubon Society headquarters in Lincoln, Mass., Government Services Administration building in Manchester, N.H., and a one-story office complex at the NASA-Lewis Center in Hampton, Va.

Such efforts will certainly raise public awareness, and perhaps acceptance, of solar energy. But more is needed if the potential impact of this unique source of power is to be realized. Simple architectural modifications, combined with present solar technology, could reportedly save 70 percent on residential energy expenditures in the Southwest. A chain of electricity-generating windmills—whose technology was well-matured half a century ago—stretching along the Aleutian Islands of Alaska, could theoretically generate 402 *billion* kilowatt-hours of electricity every year. Breaking the logjam in energy will require money, yes. But most of all it will take daring and imagination. □