Acceleration of research into ways to make solar energy technologically possible

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Solar energy has always been with us and utilized by us to some degree. When you come right down to it, even wood - man's oldest fuel -- is a by-product of solar energy.

In the past few years, however, there has been an acceleration of government and private research into ways to make widespread use of solar energy technologically possible.

Although some pioneers are talking about satellite solar power stations of the future, the reasonable expectations for what solar energy can accomplish at the present are somewhat more limited.

Solar energy is here -- to heat homes, water, swimming pools, greenhouses, even factories and office buildings -- but not without some problems. The move to solar, in other words, had best be taken with eyes open to both the potentials and the present drawbacks of solar energy. The biggest problems are economic and technical.

But with a third of the nation's energy being used to provide hot water or air at relatively low temperatures, solar energy can make a significant contribution to reducing reliance on natural gas and heating oil.

Especially with President Carter promising tax credits for homeowners and industrial plants that convert to solar energy, interest has quickened. What are the capabilities and limitations of solar energy?

"Passive systems"

Even for New York apartment buildings, rooftop solar collectors can provide hot water. But largescale use of solar collectors in cities is likely to await the massive conversion of solar energy into electricity for utilities, at least a decade away.

In the meantime, more and more builders of new homes are incorporating solar features. And at a somewhat higher cost, existing buildings can be equipped with solar collectors.

The simplest way to use solar energy is to design a building that can soak up lots of sun -- by having large windows facing south and few facing north, using lots of insulating and thick walls and floors of materials like concrete or stone that hold heat.

A well-designed house can use the sun for 25 to 40 per cent of its heating, but you might have to put up with a pretty warm house in the summer months and would probably need auxiliary heating in the winter.

Another type of "passive" solar heating depends on a two-foot thick concrete wall on the southern exposure to absorb heat and release it gradually.

More recent work has focused on using salt crystals that melt with heat to store thermal energy. Because much less volume and weight are involved, this new system can also be adapted for existing buildings.

Maria Telkes of the University of Delaware's Institute of Energy Conversion estimates that with commercial mass production methods, the cost of such a storage system can be paid back in three or four years.

'Active' systems

What are known as "active" solar systems work by collecting heat through roof-mounted panels and then conducting it through ducts or pipes to heat water or air, with the aid of a pump or fan.

Although the basic technology is fairly simple, limited production so far has kept installation costs high. That's one of the hitches, which would diminish as the costs of other fuels rise in comparison and as mass production brings costs down.

The other problem involves storage of heat. The sun doesn't shine every day. Does that mean you have to do without heat or hot water on a cloudy day? One solution is the use of a storage tank of rocks or water to hold heat, at least a couple of days' worth.

Because a storage system beyond that would be too large and expensive to be practical, you'd also need a conventional source of heat as a back-up, preferably oil or gas. Some purists depend on a wood stove or fireplace. (If the back-up system were electric, then the utility company would have to b~ able to provide enough for everyone in their area on a cold winter day.)

The key element in an "active" solar system is the collector, a glass-enclosed box with a b lack backing which absorbs the sun's rays and heats the air above it. A fan circulates the heated air. In a water system, ducts passing through the enclosed air pick up its heat or are built into the absorption panel and get their heat by conduction.

Heating the average-sized home requires 500 to 700 square feet of collectors, mounted on a south-facing roof. Right now, collectors cost as much as $20 a square foot, which makes the initial outlay pretty steep.

But the savings on fuel expenses could pay for the system in a few years. The federal government has already stated that solar energy can compete with the cost of electricity in newly built, well insulated one-family houses in some cities, including New York.

According to Hoyt C. Hottel of the Massachusetts Institute of Technology, if you want to get your money back within a reasonable period, don't spend more per square foot than ten times what you'd save on other heating fuels in a year.

President Carter wants to see solar energy used in 2.5 million homes by 1985, but so far its predominant use is for hot water systems because much fewer collectors are needed, making costs reasonable. For general heating, costs per square foot are going to have to fall considerably before such a system becomes economically practical.

But *Fortune* magazine has pointed out that each one per cent shift of energy to solar entails a capital investment of at least $20 billion. "This flow of money would support the further work that must be done by the new solar industry to shrink those heavy front-end costs."

As the costs of oil and gas continue to rise, that will also help shrink the cost gap.

Continued research is also needed to come up with more durable and efficient collectors. Breakage and corrosion are still a problem. Other improvements to increase efficiency are also possible, but expensive.

Bringing costs down

In March, the federal government made $10 million available to help home, motel and hotel owners install hot water heaters. It is hoped that this boost to the solar equipment industry will help bring down costs.

"Solar energy is so dost: to being competitive with other fuels for heating water that a stimulus such as this could very well provide the essential market boost," said Robert Fri, acting chief of the Energy Research and Development Administration.

ERDA, incidentally, has a number of pamphlets available to help potential buyers obtain the information they need.

Converting to electricity

While making solar energy generally available at an economical price is largely a matter of scale, technology to convert solar energy into electricity efficiently is still on the experimental level.

Ordinarily, sunlight falls diffusely on a given area, which is why so many collectors are needed to heat a

house. To heat water to high enough temperatures to produce steam, curved mirrors or lenses concentrate the sun's rays on a receiver. The steam can then be used to drive a turbine to produce electricity.

The other method being developed to produce electricity from the sun's rays involves photovoltaic cells made out of thin sheets of such materials as silicon, germanium or cadmium sulfide. These cells convert about 15 per cent of the sun's rays directly into electricity, but production costs are still prohibitive for large scale use. New methods and new materials may be able to reduce costs in the future.

Even if such systems worked economically, the problem of what to do on sunless days remains. Any use of solar energy for producing electricity at this point would have to be tied into a conventional electrical generating system or some other way of producing steam for the plant would have to be available. Storage systems are also being developed, but the added cost would be considerable.

The potential is there, but not for immediate reaping.

Associated technologies

There are a number of associated Technologies -- separation of hydrogen from water by electrolysis, planting trees as an energy crop, converting plant matter into methane gas -- that provide other means of tapping the sun's rays, though none are yet developed for widespread commercial use.

There is a wide spread of speculation about the future of solar energy, from pessimism that it can ever be as economically viable as fossil fuels to descriptions of the sun as the ultimate solution to this nation's and the world's energy needs.

But if energy outlook for oil and natural gas is as bleak as portrayed by President Carter, it may be worthwhile to reap whatever advantages can be gained by converting to solar energy.