

Table 1. Inputs to the environment before and after installation of desert solar energy farm with 30 percent conversion efficiency [see (1)].

Solar energy flux	Before installation (%)	After installation (%)
Reflected to space	35	5
Desert heating	65	65
Utilized in metropolitan industrial centers	0	30
Additional global heat burden		~ 30
Total	100	100

This assertion would not be correct for an economically competitive solar power system.

According to Aden Meinel and Marjorie Meinel (1), the only likely candidate for an economically competitive solar power system is high-temperature thermal conversion interfaced with state-of-the-art, high-pressure steam turbine systems. The goal of such a system would be to operate at 30 percent efficiency rather than at the 2 to 4 percent attainable at the present time. To attain this efficiency, 85 percent of the solar farm energy now reflected back to space would be utilized (see Table 1). If care were exercised in the manner of discharge, there would be no net thermal problem in desert regions. However, the industrial-metropolitan and global heat burden would be increased by the extent to which the ordinarily reflected light is captured and converted to solar power.

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References

1. A. A. Meinel and M. P. Meinel, *Univ. Ariz. Opt. Sci. Cent. Newsl.* 6, 68 (1972).

Solar Heating and Cooling

Allen Hammond (19 Apr., p. 278) omits any reference to the work of Harold Hay of California in his discussion of solar-heated houses. Hammond gives good coverage to Harry Thoma's commendable work in Washington, D.C., but the only residence which has been constructed and operated up to this time that derives all its heat from the sun and gets all its cooling from night sky radiation and evaporation is the Hay "Skytherm" system, tested for

18 months in Phoenix, Arizona, in 1967-1968. The "Skytherm" system is now in operation as a full-scale house at Atascadero, California.

Many other companies are now becoming active in the solar heating and cooling field, primarily as a result of the three contracts given by the National Science Foundation to General Electric with the University of Pennsylvania; Westinghouse with Carnegie-Mellon University and Colorado State University; and TRW Systems with Arizona State University. The reports on these three projects are available from the National Science Foundation (1).

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Notes

1. A limited number of copies is available from the RANN Documents Center, Room 601, National Science Foundation, 1800 G Street, NW, Washington, D.C. 20550.

Wind Power

Martin Wolf (19 Apr., p. 382) comments on wind power and states that "A conceptual design with aeroturbines stationed off the Atlantic coast to produce 160 billion kilowatt-hours of electricity a year has been completed for the New England region." It is possible to estimate the cost and magnitude of such a wind-power project.

A megawatt of power can be extracted from the air with a very efficient wind turbine if the wind is blowing at 20 knots and the diameter of the turbine is about 60 meters. The Putnam wind generator installed at Granpa's Knob, Vermont, in the 1940's was about that size. The cost of building similar generators today is estimated to be at least \$1 million if they are mass produced (1). To produce 160 billion kilowatt-hours a year (assuming an average wind of 20 knots) would require more than 15,000 wind generating units. The cost of installation of the units alone, not counting the cost of the offshore platforms, would thus be in excess of \$15 billion. If these wind generators were placed in a line on platforms 100 meters apart, the line would stretch for 1500 kilometers, which is about the length of the entire New England coast.

Only 15 modern coal- or nuclear-fueled power plants will supply the same amount of electricity as 15,000 wind turbines, and their cost of installa-

tion is at least five times less. Also, electricity can be produced at will at conventional power plants, whereas the wind is undependable.

There is no doubt that there is plenty of power in the wind. The real problem is in economically extracting this power, and since the fundamental technology for building wind machines has already been developed, reasonable estimates of the cost of extracting wind power can be made. My analysis indicates that large-scale generation of electricity by harnessing the wind, even as a supplemental source of power, is not feasible economically.

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References

1. E. W. Hewson, "Wind power potential in selected areas of Oregon" (Technical Report, Department of Atmospheric Sciences, Oregon State University, Corvallis, 1973).

Industrial Energy Conservation:

Dual Incentives

Charles A. Berg, in his article on industrial energy conservation (19 Apr., p. 264), mentions that industry has not felt obliged to conserve energy in the past. There are two major reasons for industry to save energy: economic (it pays) and patriotism (joining in a common effort to meet a common objective). However, without the first incentive, the second will not be able to go very far or be maintained for very long.

Industries measure their efficiency in the rate of return on capital investment (1) and use this same gauge to determine the advisability of current investments. Suppose a company has a current rate of return on capital of $r = P/K$, where P is the profit at the current level of sales and K is the capital invested. If an additional investment in energy-conserving alterations and equipment ΔK produces reduction of operating expenses, which in turn produces an increased profit ΔP , the company will be inclined to make the investment if $r \leq \Delta P/\Delta K$ (for simplicity, the cost of capital is included in ΔK). Typically r is in the range of 15 to 20 percent per year (2).

There are a number of reasons why companies hesitate to make energy-saving investments, even those which will return r on the investment.

- 1) There is always some amount of