Solar Energy: Proposal for a Major Research Program

Despite growing interest in solar energy, little real research has been done. In contrast to fusion research, which has had the high-powered backing of a tightly knit segment of the physics community, solar energy research has been largely the hobby of a few isolated investigators. Careful assessments of solar energy's potential contribution to the U.S. energy supply and comprehensive proposals for its development have been lacking.

A report by a National Science Foundation–National Aeronautics and Space Administration panel released last month goes part way toward remedying this neglect (*1*). Solar energy, the panel asserts, is in principle a significant national resource. Its development will require a large commitment of money and research effort, and even so, the cost of solar technology may delay its use in many applications. Nonetheless, the report claims, by the year 2020 solar energy could provide 35 percent of heating and cooling in buildings, 30 percent of the nation's gaseous fuels and 10 percent of its liquid fuels, and 20 percent of electrical needs.

The NSF/NASA report was prepared as part of a national energy study for the now-defunct Office of Science and Technology. Optimistic in tone, it assesses various methods for converting sunlight to useful energy and finds no technical barriers to their application. The report outlines the research needed to bring the requisite technologies into existence and appeals for the funds to carry out the work. It also attempts to ascertain the impact of these technologies on the U.S. energy system. Special attention is given to three applications of solar energy: the thermal needs of buildings, production of artificial fuels, and generation of electricity.

The report notes that the cost of solar heating is competitive now with the cost of heating by fossil fuels in some parts of the country and could supply as much as 80 percent of the heat needs in sunny climates (Fig. 1). A 10-year R & D program costing $100 million is proposed to bring about commercial availability of solar heating and cooling equipment. Energy storage and auxiliary energy sources would be needed.

Methods to produce artificial fuels from organic materials could also be developed within 10 years, according to the report. Both organic wastes—farm residues, animal wastes, and urban sewage—and materials which might be grown specifically for energy production—plants, algae, and trees—could become renewable sources of fuels. The solar energy captured in these materials would be further converted into fuels by pyrolysis, fermentation, chemical reduction, or mechanical methods. Depending on the material and the process involved, solid, liquid, and gaseous fuels could be produced, and the report recommends a $172 million R & D effort to develop these processes. Additional funds are recommended for research into improved photosynthetic production of organic materials and their combustion.

Generation of electricity with solar energy at costs competitive with nuclear power will take longer, the report suggests, and will require more expensive R & D efforts. Photovoltaic and thermal conversion of sunlight both require large man-made collectors that are invariably the most costly component of these systems, but they offer relatively straightforward approaches to solar power. Less efficient but distinctly feasible are the natural collecting mechanisms that give rise to winds and temperature differences in the oceans. The report proposes more than $1 billion to develop and construct a solar thermal demonstration plant and more than $0.5 billion for each of the other three systems.

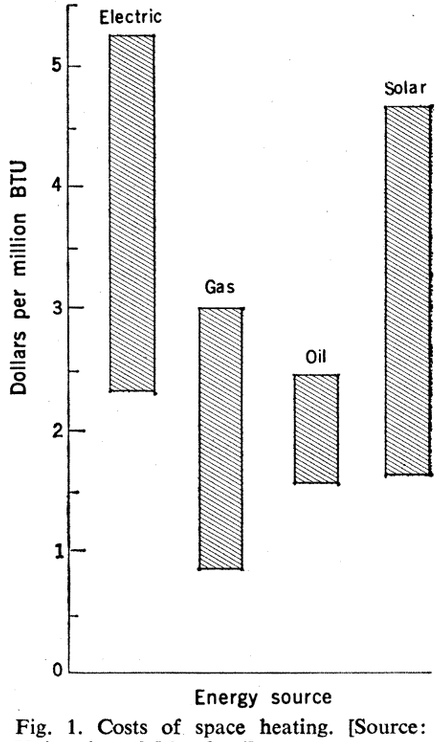

Fig. 1. Costs of space heating. [Source: University of Maryland]

In contrast to these enormous sums, the $5 million now being spent on solar energy research seems miniscule. But even with this modest effort some progress is being made. Photovoltaic power supplies for remote use—on an offshore drilling platform, for example—are being produced and sold commercially in competition with battery units. Construction has begun on a demonstration house at the University of Delaware that will be powered by photovoltaic cells. New engineering estimates by Aerospace Corporation put the cost of electricity from solar thermal power plants in 1990 closer to economic competitiveness with nuclear power.

The total solar energy program proposed by the NSF/NASA panel comes to a whopping $3.5 billion. Even excluding the costly demonstration plants, the R & D budget still amounts to $1.5 billion, a sum that may be hard to justify. Whether or not the total is excessive, it is comparable to the Atomic Energy Commission's $650 million proposal for an expanded fusion research effort in the 1970's and the $680 million price-tag for geothermal research suggested in the Hickel report (*2*). (Both estimates exclude demonstration plants and, for fusion, equipment to demonstrate scientific feasibility.) As these amounts illustrate, the cost of developing new energy sources will be high. Nonetheless, increased support would seem to be in the national interest.

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References

1. NSF/NASA Solar Energy Panel, *Solar Energy as a National Resource* (Department of Mechanical Engineering, University of Maryland, College Park, 1973). The panel was headed by Paul Donovan of NSF and William Woodward of NASA. Copies are available from the Department of Mechanical Engineering, University of Maryland.
2. W. J. Hickel *et al.*, *Geothermal Energy* (University of Alaska, College, 1972).