billion dollars in the United States, comparable to that of several other energy related industries.

Varying amounts of technology development are required to assure the technical and economic feasibility of the different solar energy utilization methods. Several of these developments are far enough along that the paths can be analyzed from the present time to the time of demonstration of technical and economic feasibility, and from there to production and marketing readiness. After that point, a period of market introduction will follow, which will differ in duration according to the type of market addressed. It may be noted that the present rush to find relief from the current energy problem, or to be an early leader in entering a new market, can entail shortcuts in sound engineering practice, particularly in the areas of design for durability and easy maintenance, or of proper application engineering. The result can be loss of customer acceptance, as has been experienced in the past with various products, including solar water heaters. Since this could cause considerable delay in achieving the expected total energy impact, it will be important to spend adequate time at this stage for thorough development.

Two other aspects are worth mentioning. The first is concerned with the economic impacts. Upon reflection on this point, one will observe that large-scale solar energy utilization will not cause a greater impact than other new energy sources, based on the reasoning that a self-consistent set of conditions will have to be fulfilled in order to achieve such large-scale use. Without cost competitiveness, other energy resources would fill the requirements, or, if their resource and cost structure also would create severe problems, the economic forecasts simply cannot be fulfilled. We also should not think of a "solar-only" energy future. First, there is still enough coal to last for several hundred years. Second, there should be enough fissionable fuel available to operate breeder reactors for a similar time span, and geothermal energy could satisfy some requirements for a long time. And finally, there may be fusion. It would be unlikely that any one of the available options should play a really dominant role. Rather, we should expect to be using an energy mix, just as we do now, with each energy source supplying the requirements which it can satisfy in the most suitable way, and solar energy should play an important role in this long-range future.

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Group I: Contributed Articles

(Reprints Available)

C. A. Berg, "Energy Conservation through Effective Utilization," **181,** 128 (1973).

G. A. Lincoln, "Energy Conservation," **180**, 155 (1973).

L. A. Sagan, "Human Costs of Nuclear Power," **177**, 487 (1972).

A. W. Eipper, "Pollution Problems, Resource Policy, and the Scientist," **169**, 11 (1970).

A. M. Weinberg, "Social Institutions and Nuclear Energy," **177**, 27 (1972).

D. Chapman, T. Tyrell, and T. Mount, "Electricity Demand Growth and the Energy Crisis," **178**, 703 (1972).

E. Hirst and J. D. Moyers, "Efficiency of Energy Use in the United States," **179**, 1299 (1973).

D. Pimentel, L. E. Hurd, A. C. Bellotti, M. J. Forster, I. N. Oka, O. D. Sholes, and R. J. Whitman, "Food Production and the Energy Crisis," **182**, 443 (1973).

E. F. Osborn, "Coal and the Present Energy Situation," **183**, 477 (1974).

J. O'M. Bockris, "A Hydrogen Economy," **176**, 1323 (1972).

L. W. Jones, "Liquid Hydrogen as a Fuel for the Future," **174**, 367 (1971).

D. F. Othmer and O. A. Roels, "Power, Fresh Water, and Food from Cold, Deep Sea Water," **182**, 121 (1973).

T. B. Reed and R. M. Lerner, "Methanol: A Versatile Fuel for Immediate Use," **182**, 1299 (1973).

W. E. Winsche, K. C. Hoffman, and F. J. Salzano, "Hydrogen: Its Future Role in the Nation's Energy Economy," **180**, 1325 (1973).

Group II: Staff-Written Articles—News and Comment

L. J. Carter, "Deepwater Ports: Issue Mixes Supertankers, Land Policy," **181**, 825 (1973).

"Rio Blanco: Stimulating Gas and Conflict in Colorado," **180**, 844 (1973).

R. Gillette, "Budget: Energy," **183**, 635 (1974).

"Synthetic Fuels: Will Government Lend the Oil Industry a Hand?" **183**, 644 (1974).

"Energy: The Muddle at the Top," **182**, 1319 (1973).

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"Nuclear Safety: Atomic Energy Commission Report Makes the Best of It," **179**, 360 (1973).
"Nuclear Safety (IV): The Barriers to Communications," **177**, 1080 (1972).
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N. Hawkes, "Energy in Britain: Shopping for a New Reactor," **183**, 57 (1974).
C. Holden, "Energy: Shortages Loom, But Conservation Lags," **180**, 1155 (1973).
D. Shapley, "Law of the Sea: Energy, Economy Spur Secret Review of U.S. Stance," **183**, 290 (1974).
J. Walsh, "Electric Power Research Institute: A New Formula for Industry R & D," **182**, 263 (1973).
"Britain and Energy Policy: Problems of Interdependence," **180**, 1343 (1973).

Group III: Staff-Written Articles—Research News

Energy and the Future, a AAAS book by Allen Hammond, William Metz, and Thomas Maugh II contains 22 articles that take a long-range look at energy. The book is based on a series of articles in *Science*, $4.95 ($4.45 members' price) paperbound. $9.95 ($8.95 members' price) casebound. Titles are as follows:

"Energy from Fossil Fuels"
"Gasification: A Rediscovered Source of Clean Fuels"
"Power Gas and Combined Cycles: Clean Power from Fossil Fuels"
"Magnetohydrodynamic Power: More Efficient Use of Coal"
"Nuclear Energy"
"Fission: The Pro's and Con's of Nuclear Power"
"Breeder Reactors: The Future of Nuclear Power"
"Alternative Energy Sources"
"Geothermal Energy: An Emerging Major Resource"
"Solar Energy: The Largest Resource"
"Photovoltaic Cells: Direct Conversion of Solar Energy"
"Fuel from Wastes: A Renewable Energy Source"
"Magnetic Containment Fusion: What Are the Prospects?"
"Laser Fusion: A New Approach to Thermonuclear Power"
"Energy Transmission"
"Transmission Lines: Three New Ways to Carry Electricity"
"Fuel Cells: Dispersed Generation of Electricity"
"Hydrogen: Synthetic Fuel of the Future"
"Energy Conservation"
"Conservation of Energy: The Potential for More Efficient Use"
"Energy Needs: Projected Demands and How to Reduce Them"
"Energy and the Future: Research Priorities and Energy Policy"

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A. L. Hammond, "Solar Energy: Proposal for a Major Research Program," **179**, 1116 (1973).
W. D. Metz, "Ocean Temperature Gradients: Solar Power from the Sea," **180**, 1266 (1973).
A. L. Hammond, "Dry Geothermal Wells: Promising Experimental Results," **182**, 43 (1973).

Group IV: Editorials

P. H. Abelson, "Out of the Energy Crunch by 1976," **183**, 707 (1974).
"No Easy Way Out of Energy Crisis," **183**, 475 (1974).
"Underground Gasification of Coal," **182**, 1297 (1973).
"Increasing World Energy Supplies," **182**, 1087 (1973).
"Energy Independence," **182**, 779 (1973).
"Let the Bastards Freeze in the Dark," **182**, 657 (1973).
"The Urgent Need for Energy Conservation," **182**, 339 (1973).
"Importance of Petroleum," **180**, 1127 (1973).
"Energy and National Security," **179**, 857 (1973).

Reprints of articles listed in Group I are available. To inquire about reprints of other articles, write to Dawn Dominguez, *Science*, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005.

Forthcoming Events on Energy

May

2–7. **High Energy Accelerators**, 9th intern. conf., Stanford, Calif. (R. B. Neal, Stanford Linear Accelerator Center, P.O. Box 4349, Stanford 94305)

7–10. Conference on **Gas-Cooled Reactors: HTGR and GCFBR**, American Nuclear Soc., Gatlinburg, Tenn. (P. R. Kasten, Oak Ridge Natl. Lab., P.O. Box Y, Oak Ridge, Tenn. 37830)

9–11. Conference on **Enercology**, Alma, Mich. (R. Kapp, Alma College, Alma 48801)

21–23. **Environmental** Exposition, 4th intern., Chicago, Ill. (A. Cragg, Conference and Exposition Management Co., 34 W. Putnam Ave., Greenwich, Conn. 06830)

28–31. **Confinement of Radioactivity in Utilisation of Nuclear Energy**, 7th intern. congr., Versailles, France. (L. Fitoussi, Societé Française de Radioprotection, CEN.FAR, B.P. 6, 92 260 Fontenay aux Roses, France)

29–31. International symp. on the **Effects of the Energy Shortage on Transportation Balance**, University Park, Pa. (Energy/Transport Symp., Keller Conf. Center, University Park 16802)

June

8–12. **Nuclear Energy** Conf., European Federation of Chemical Engineers, Paris, France. (Societé de Chimie Industrielle, 80, Ave. du 18-juin-1940, 9500 Rueil-Malmaison, France)

9–12. **Nuclear Reactors**, 14th intern. conf., Canadian Nuclear Assoc., Montreal, Canada. (J. A. Weller, CNA, Suite M20, 65 Queen St., W, Toronto, M5H 2M5, Canada)

August

18–23. Conference on the **Geography and Politics of Energy**, Potsdam, N.Y. (V. Minotti, State Univ. College at Potsdam, Potsdam 13676)

21–23. International **Solar Energy** Soc., Fort Collins, Colo. (S. Karaki, Dept. of Civil Engineering, Colorado State Univ., Fort Collins 80521)

25–28. **Nuclear Power Plant Siting**, American Nuclear Soc., Portland. (J. Hind, General Electric Co., 175 Curtner Ave., San Jose, Calif. 95114)

26–30. Circum-Pacific **Energy and Mineral Resources** Conf., sponsored by the American Assoc. of Petroleum Geologists, Committee for Coordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas, and the Pacific Science Assoc.; cosponsored by the American Assoc. for the Advancement of Science, Honolulu, Hawaii. (M. T. Halbouty, CPEMRC, Michel T. Halbouty Bldg., 511 Westheimer Rd., Houston, Tex. 77027)

September

22–27. **Economic and Environmental Challenges of Future Energy Requirements**, 9th world energy conf., Detroit, Mich. (U.S. Natl. Committee, WEC, c/o Engineers Joint Council, 345 E. 47 St., New York, N.Y. 10017)