

American Association for the Advancement of Science

Science serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

Publisher: J. Thomas Ratchford, *Acting*

Editor: Daniel E. Koshland, Jr.

Deputy Editors: Philip H. Abelson (*Engineering and Applied Sciences*); John I. Brauman (*Physical Sciences*)

EDITORIAL STAFF

Managing Editor: Patricia A. Morgan

Assistant Managing Editors: Nancy J. Hartnagel, John E. Ringle

Senior Editors: Eleanore Butz, Ruth Kulstad

Associate Editors: Martha Collins, Barbara Jasny, Katrina L. Kelner, Edith Meyers, Phillip D. Szurromi, David F. Voss

Letters Editor: Christine Gilbert

Book Reviews: Katherine Livingston, *editor*; Deborah F. Washburn

This Week in Science: Ruth Levy Guyer

Chief Production Editor: Ellen E. Murphy

Editing Department: Lois Schmitt, *head*; Mary McDaniel, Barbara E. Patterson

Copy Desk: Lyle L. Green, Sharon Ryan, Beverly Shields, Anna Victoreen

Production Manager: Karen Schools

Graphics and Production: Holly Bishop, Kathleen Cosimano, Eleanor Warner

Covers Editor: Grayce Finger

Manuscript Systems Analyst: William Carter

NEWS STAFF

News Editor: Barbara J. Culliton

News and Comment: Colin Norman, *deputy editor*; Mark H. Crawford, Constance Holden, Eliot Marshall, Marjorie Sun, John Walsh

Research News: Roger Lewin, *deputy editor*; Deborah M. Barnes, Richard A. Kerr, Gina Kolata, Jean L. Marx, Arthur L. Robinson, M. Mitchell Waldrop

European Correspondent: David Dickson

BUSINESS STAFF

Associate Publisher: William M. Miller, III

Business Staff Manager: Deborah Rivera-Wienhold

Membership Recruitment: Gwendolyn Huddle

Member and Subscription Records: Ann Ragland

Guide to Biotechnology Products and Instruments: Shauna S. Roberts

ADVERTISING REPRESENTATIVES

Director: Earl J. Scherago

Production Manager: Donna Rivera

Advertising Sales Manager: Richard L. Charles

Marketing Manager: Herbert L. Burklund

Sales: New York, NY 10036: J. Kevin Henebry, 1515 Broadway (212-730-1050); Scotch Plains, NJ 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); Chicago, IL 60611: Jack Ryan, Room 2107, 919 N. Michigan Ave. (312-337-4973); San Jose, CA 95112: Bob Brindley, 310 S. 16 St. (408-998-4690); Dorset, VT 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581); Damascus, MD 20872: Rick Sommer, 24808 Shrubbery Hill Ct. (301-972-9270); U.K., Europe: Nick Jones, +44(0647)52918; Telex 42513; FAX (0392) 31645.

Instructions for contributors appears on page xi of the 27 March 1987 issue. Editorial correspondence, including requests for permission to reprint and reprint orders, should be sent to 1333 H Street, NW, Washington, DC 20005. Telephone: 202-326-6500.

Advertising correspondence should be sent to Tenth Floor, 1515 Broadway, NY 10036. Telephone 212-730-1050 or WU Telex 968082 SCHERAGO.

New Technologies in the Generation of Electricity

The electric utilities are in the later phases of a horrendous experience resulting from their choices and scheduling decisions about generating capacity that were made during the 1970s. They chose to build huge plants and were overly optimistic about growth in demand. Their trauma was exacerbated by problems with nuclear reactors and high interest rates during construction and by the need to curtail acid emissions from coal-fired plants. The time required for design, obtaining permits, and construction of 1000-megawatt (MW) and larger units was 8 to 15 years. During 1987 and 1988 most of the plants now under construction will be completed, and with time, excess capacity will disappear, probably to be followed by shortages.

The capacity requirements of the next decade are uncertain, but new technologies have the potential to forestall many future problems, by providing flexibility in the adding of capacity and freedom from pollution. In the new approach, units of the order of 100-MW capacity will be added in times on the order of 2 or 3 years.

A key technological development is a series of combustion turbines that can run reliably for long periods at high temperatures. One version being tested by General Electric can operate at 1260°C. The heat from the turbine can be used to make steam to drive another turbine.

The combustion turbines can employ natural gas, fuel oil, or CO + H₂ derived from gasification of coal. The utilities see an opportunity for phased addition of increased generating capacity. The first phase would be the installation of 100-MW gas turbine capacity that would use natural gas and serve for peaking purposes. Later the heat recovery and steam turbine would be added to yield another 100 MW. Finally, were natural gas to become too expensive, coal gasifiers could be installed, leading to a total output of 300 MW. One version of the gasification step has been operated successfully for about 3 years at the Cool Water plant in California. Emissions from the plant are pollution-free. The Cool Water unit employs a Texaco gasifier. Both Dow Chemical and Shell have developed their own versions of gasifiers, and other companies have also been active.

A panel discussion at the 2 April annual meeting of the Gas Research Institute in Chicago cited some of the advantages of the use of natural gas in the generation of electricity. Generating facilities can be constructed rapidly. Capital costs of equipment are small. Siting problems are minimal. The generators can be located close to loads, thus cutting transmission losses. There are no emissions of SO₂. These advantages justify use of a fuel whose cost is greater than coal. A major uncertainty is the longer term price of gas after the gas bubble disappears.

The use of co-generation is a growing phenomenon that may come to have a considerable role. At the panel discussion, William T. McCormick of Consumers Power told of a project being developed at Midland, Michigan. There, gas turbines will be used to generate 1300 MW of electricity. Low-temperature heat will be delivered to Dow Chemical to be used in chemical processing. Vendors have guaranteed on-line availability of 85 to 90 percent, which is much better than that of the usual power plant. Overall thermal efficiency will be 43 percent. Were new turbines available that are currently being tested the efficiency would be 47 percent. Many coal-fired power plants operate in the low 30s. Co-generation is likely to have increasing applications in commercial establishments where both electricity and heat are required. Again, high thermal efficiencies can be attained. As an alternative to turbines, electricity can be generated and heat recovered from natural gas by means of fuel cells. This is a technology recently developed under sponsorship of the Gas Research Institute.

There is no question about the versatility of natural gas as an energy source and its potential role in the generation of electricity, the principal question for the future is its price and the quantities available. Present spot prices of about \$1.50 per million BTUs discourage exploration and drilling.

In any event, the electric utilities are embarked on a new and flexible course in their choice of generating equipment.—PHILIP H. ABELSON