

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.

Editorial Board

1978: RICHARD E. BALZHISER, JAMES F. CROW, HANS LANDSBERG, EDWARD NEY, FRANK W. PUTNAM, MAXINE SINGER, PAUL E. WAGGONER, F. KARL WILLENBROCK

1979: E. PETER GEIDUSCHEK, WARD GOODENOUGH, N. BRUCE HANNAY, MARTIN J. KLEIN, FRANKLIN A. LONG, NEAL E. MILLER, JEFFREY J. WINE

Publisher

WILLIAM D. CAREY

Editor

PHILIP H. ABELSON

Editorial Staff

Managing Editor

ROBERT V. ORMES

Assistant Managing Editor

JOHN E. RINGLE

News and Comment: BARBARA J. CULLITON, Editor;

LUTHER J. CARTER, CONSTANCE HOLDEN, DEBORAH SHAPLEY, R. JEFFREY SMITH, NICHOLAS WADE, JOHN WALSH. *Editorial Assistant*, SCHERRAINE MACK

Research News: ALLEN L. HAMMOND, Editor;

RICHARD A. KERR, GINA BARI KOLATA, JEAN L. MARX, THOMAS H. MAUGH II, WILLIAM D. METZ, ARTHUR L. ROBINSON. *Editorial Assistant*, FANNIE GROOM

Associate Editors: ELEANORE BUTZ, MARY DORF-

MAN, SYLVIA EBERHART, JUDITH GOTTLIEB

Assistant Editors: CAITILIN GORDON, RUTH KUL-

STAD, LOIS SCHMITT

Book Reviews: KATHERINE LIVINGSTON, Editor;

LINDA HEISERMAN, JANET KEGG

Letters: CHRISTINE KARLIK

Copy Editors: ISABELLA BOULDIN, OLIVER HEATWOLE

Production: NANCY HARTNAGEL, JOHN BAKER; YA

LI SWIGART, ELEANOR WARNER; JEAN ROCKWOOD, LEAH RYAN, SHARON RYAN

Covers, Reprints, and Permissions: GRAYCE FINGER,

Editor; CORRINE HARRIS, MARGARET LLOYD

Guide to Scientific Instruments: RICHARD SOMMER

Assistant to the Editors: RICHARD SEMIKLOSE

Membership Recruitment: GWENDOLYN HUDDLE

Member and Subscription Records: LYNN RAGLAND

EDITORIAL CORRESPONDENCE: 1515 Massachu-

setts Ave., NW, Washington, D.C. 20005. Area code

202. General Editorial Office, 467-4350; Book Reviews,

467-4367; Guide to Scientific Instruments, 467-4480;

News and Comment, 467-4430; Reprints and Per-

missions, 467-4483; Research News, 467-4321; Cable:

Advancesci, Washington. For "Instructions for Contrib-

utors," write the editorial office or see page xv, *Science*,

30 September 1977.

BUSINESS CORRESPONDENCE: Area Code 202.

Business Office, 467-4411; Circulation, 467-4417.

Advertising Representatives

Director: EARL J. SCHERAGO

Production Manager: MARGARET STERLING

Advertising Sales Manager: RICHARD L. CHARLES

Marketing Manager: HERBERT L. BURKLUUD

Sales: NEW YORK, N.Y. 10036: Steve Hamburger, 1515

Broadway (212-730-1050); SCOTCH PLAINS, N.J. 07076:

C. Richard Callis, 12 Unami Lane (201-889-4873); CHI-

CAGO, ILL. 60611: Jack Ryan, Room 2107, 919 N. Michi-

gan Ave. (312-DE-7-4973); BEVERLY HILLS, CALIF.

90211: Winn Nance, 111 N. La Cienega Blvd. (213-657-

2772); DORSET, VT. 05251: Fred W. Dieffenbach, Kent

Hill Rd. (802-867-5581)

ADVERTISING CORRESPONDENCE: Tenth floor,

1515 Broadway, New York, N.Y. 10036. Phone: 212-

730-1050.

Intercountry Energy Comparison

Few energy comparisons have involved an analysis of factors leading to differences among the major industrial countries. The usual procedure has been to compare the ratios of total energy consumption to gross domestic product (GDP) on a per capita basis. Such comparisons show that the United States is topped only by Canada in its ratio of energy use to GDP, and one is left with the impression that the United States might easily halve its energy consumption while maintaining its current gross national product. However, in some respects the United States is more efficient than other countries. In the transportation of freight, the energy used per ton-mile is less here than elsewhere.

To benefit from the experience and technology of other countries, it is necessary to examine in detail the various factors involved in energy use. In a recent book by Darmstadter *et al.** a comparative analysis is presented of energy use by the United States, Canada, France, West Germany, Italy, the Netherlands, Sweden, the United Kingdom, and Japan. The authors set forth the complexity of making comparisons and the difficulties in measuring efficiency and wastefulness in energy consumption. They focus on the year 1972; however, modes of energy use change only slowly so that the analysis is relevant.

The crude ratio of energy to GDP conceals differences in energy sources, physical factors, and mix of productive activities. Canada and Sweden have abundant hydroelectricity; others depend on imported oil. Still others employ oil and substantial amounts of coal. Physical factors play an important role. The Netherlands, with a small area and a high population density, differs from the United States or Canada in transportation needs. Some kinds of productive activities are far more energy-intensive than others. Making steel utilizes much more energy per dollar of output than does agriculture.

When the various factors are taken into account, the United States and Canada stand out as relatively the most energy-consuming countries. An examination of components of usage in the various sectors reveals that transportation is the major factor in the difference between the United States and Canada and the other countries. Residents of the United States, for example, travel an average of twice as far each year as do residents of other countries. We use less public transportation and our automobiles get less mileage. Fuel economy for cars is in the process of being changed. However, our comparatively low population density and long distances will continue to influence energy consumption in transportation.

The United States uses relatively more energy in space heating and cooling than do the other countries. In part this is due to the prevalence of single dwellings and to inadequate insulation. Insulation deficiencies are being partially overcome. But the heat losses inherent in single dwellings will remain for a long time. Homeowners are not about to abandon a multitrillion-dollar investment.

Industrial use of energy in the United States in 1972 was about 20 percent greater per unit product than the average for the other countries. At that time, the principal energy source was natural gas; the price was a tiny fraction of its present value. With higher energy costs, industry has been achieving greater energy efficiency. The gap between the United States and other countries is probably narrowing.

Darmstadter *et al.* frequently cite the influence of price in determining energy consumption. People of the United States enjoyed comparatively cheap energy for many decades. The present transportation system, housing patterns, and industrial processes reflect that past. Adjustment to the new realities will take a long time.—PHILIP H. ABELSON

*J. Darmstadter, J. Dunkerley, J. Alterman, *How Industrial Societies Use Energy: A Comparative Analysis* (Johns Hopkins University Press (1977) for Resources for the Future, Inc., Washington, D.C.)