Energy Transitions

Long-Term Perspectives

Edited by Lewis J. Perelman,
August W. Giebelhaus,
and Michael D. Yokell

AAAS Selected Symposium **48**

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AAAS Selected Symposia Series

This book is based on a symposium which was held at the 1979 AAAS National Annual Meeting in Houston, Texas, January 3-8. The symposium was sponsored by the Society for the History of Technology and by AAAS Sections K (Social and Economic Sciences) and L (History and Philosophy of Science).

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About the Book

This book is among the first to examine the social, political, economic, and environmental dimensions of major long-term changes in the systems of energy supply and use. Providing a uniquely holistic perspective on the dynamics of energy and societal changes, the authors examine historical examples of major energy transitions--from petroleum and natural gas to either renewable resources or nuclear fission (or fusion); analyze the potential impact of the coming transition; and assess the implications of long-term energy transitions for present government energy policies.

About the Series

The *AAAS Selected Symposia Series* was begun in 1977 to provide a means for more permanently recording and more widely disseminating some of the valuable material which is discussed at the AAAS Annual National Meetings. The volumes in this *Series* are based on symposia held at the Meetings which address topics of current and continuing significance, both within and among the sciences, and in the areas in which science and technology impact on public policy. The *Series* format is designed to provide for rapid dissemination of information, so the papers are not typeset but are reproduced directly from the camera-copy submitted by the authors. The papers are organized and edited by the symposium arrangers who then become the editors of the various volumes. Most papers published in this *Series* are original contributions which have not been previously published, although in some cases additional papers from other sources have been added by an editor to provide a more comprehensive view of a particular topic. Symposia may be reports of new research or reviews of established work, particularly work of an interdisciplinary nature, since the AAAS Annual Meetings typically embrace the full range of the sciences and their societal implications.

WILLIAM D. CAREY
Executive Officer
American Association for
the Advancement of Science

About the Editors and Authors

Lewis J. Perelman *is a senior scientist in the Social Sciences Group at the Jet Propulsion Laboratory; his areas of specialization are solar energy, social impact assessment, program evaluation, and diffusion of innovations. A former program planner and policy analyst at the Solar Energy Research Institute, he has written extensively on resources, the environment, and social and behavioral change. He is the author of* Solar Energy Program Evaluation *(with D. Kline; Lexington, in press) and* The Global Mind: Beyond the Limits to Growth *(Mason Charter, 1976).*

August W. Giebelhaus, *an historian of economics, business, and technology, is an assistant professor at Georgia Institute of Technology. His primary area of research is energy history, and he is the author of* Business and Government in the Oil Industry: A Case of Sun Oil, 1876-1945 *(JAI Press, 1980) and general editor of* Dictionary of the History of the Petroleum and Petrochemical Industries *(Greenwood Press, forthcoming). Currently he is associate editor of* Technology and Culture.

Michael D. Yokell, *a specialist in energy and resource and environmental economics, is president and chief economist of Resource Management Consultants, Inc., in Boulder, Colorado. A former senior economist at the Solar Energy Research Institute and faculty member at the University of California-Berkeley and Washington State University, he is the author of several books, including* Yellowcake: The International Uranium Cartel *(with J. Taylor; Pergamon, 1979) and* Environmental Benefits and Costs of Solar Energy *(Lexington, forthcoming).*

Mark N. Christensen *is a professor in the Energy and Resources Program at the University of California-Berkeley and codirector of the multidisciplinary, DOE-funded study,*

"Distributed Energy Systems in California's Future." His publications include numerous articles and several texts in the field of geology.

Gregory A. Daneke is associate professor and director of the Environmental and Energy Planning and Administration Program at the University of Arizona. He has been a visiting professor in the Center for Technology Administration at The American University, a visiting scholar with the Energy Information Exchange Program of the U.S. State Department, and a member of the National Energy Planning Review Team of the U.S. General Accounting Office. He has published extensively on policy analysis, natural resources management, and energy systems assessment; most recently, Policy Analysis and the Public Interest (Allyn and Bacon, 1980) and Public Administration and Energy Policy (with G. Lagassa; D.C. Heath, 1980).

Ethan B. Kapstein is energy education director for the Massachusetts Audubon Society and a partner in the energy consulting firm, Butti, Kapstein and Perlin (Washington, D.C.; Santa Monica, CA). As a visiting scholar with the Department of Energy, he conducted research on the history, politics, and economics of solar energy and founded and edited the Energy History Report. In 1977-1978 he was a Fellow of the Rockefeller Foundation conducting research on solar energy in developing countries, and he currently holds a fellowship from the National Endowment for the Arts.

Arnold Krammer is a professor of history at Texas A & M University. A specialist in German industrial and foreign relations, he is principal investigator of the "German Document Retrieval Project," a study of Nazi Germany's industrial records on synthetic fuel and coal conversion for possible application to current U.S. energy problems. He has numerous publications in his field, including Nazi Prisoners of War in America (Stein & Day, 1979).

Joseph A. Pratt is an assistant professor of business administration at the University of California-Berkeley; his field of specialty is energy and business history. Currently he is a visiting scholar of the U.S. Department of Energy. He is the author of The Growth of a Refining Region: Twentieth Century Growth of the Houston Area (JAI Press, in press).

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Introduction

Throughout most of human history, humankind has relied on the so-called "renewable" energy resources--wood, plants, animals, wind, and falling water--for its energy needs. In the nineteenth century, a major transition occurred to reliance on a fossil energy source: coal. The twentieth century has seen a second major energy transition from coal to petroleum and natural gas. Now another important energy system transition has begun. Within the next hundred years, the United States and other industrialized nations will have to make a new transition to reliance either on nuclear fission and fusion sources or, what now seems more likely, the traditional "renewable" resources.

The recent and continuing debate on national energy policies has focused almost exclusively on near-term problems, rather than on the requirements of the coming long-term energy transition. In the 1970s, energy policies have been as erratic and ephemeral as the transient crisis in fossil fuel supply and demand. Public and legislative interest in energy policy has fluctuated in inverse proportion to current inventories of gasoline, diesel fuel, heating oil, or natural gas. Transient supply constraints bring a flood of proposals for "crash" programs; subsequent supply surpluses bring a rapid relaxation to political apathy. On average, there has been relatively little social adjustment to the inevitable depletion of conventional fossil fuels. One reason for the lack of success in coming to grips with America's festering energy crisis may be the general lack of long-term vision of where the nation has come from and of where it could be going.

This book attempts to bring a longer-term perspective to the study of national energy policy than that of most of the existing, vast literature on the subject. The volume is far from being either flawless or comprehensive, but may be

unique in its combination of disciplines and viewpoints. The authors represent the disciplines of history, economics, and the political, physical, and behavioral sciences; they simultaneously assess past, present, and future issues of national energy policy. Because the authors have collaborated only within the symposium at the 1979 AAAS Annual Meeting on which this volume is based, the degree of integration among the various essays is very limited. Nevertheless, this book at least should suggest the potential benefit of such multidisciplinary collaboration in long-term energy policy analyses. Certainly the authors have found even this limited collaboration a rewarding experience.

The focus of the book progresses more or less chronologically from the past to the near term to the more distant future. The contents are comprised of two parts. The four articles which comprise the first half of the book deal with historical cases relevant to energy transitions; they were solicited by August Giebelhaus on behalf of the Society for the History of Technology. The articles in the second half were solicited for the AAAS symposium by Michael Yokell and Lewis Perelman, and deal primarily with current and future energy policy issues.

Consistent with the overall concern with the coming transition from fossil fuels to renewable energy resources, six of the eight papers are concerned explicitly with solar energy (and conservation); the remaining two (by Pratt and Krammer) address topics in the history of fossil fuels with important relevance to future energy policy.

In "The Ascent of Oil", Joseph Pratt describes the first major American energy transition in the twentieth century: from coal to oil. Pratt's synopsis illuminates the historical roots of the petroleum industry's present dominance, and also suggests some of the difficulty in resurrecting coal as a replacement for oil and gas. Pratt observes that the success of oil in displacing coal as a principal energy source can be attributed largely to oil's economy and technical superiority in transportation and other applications. However, some additional reasons for oil's ascendance which are less commonly recognized are that oil was tied to the regional development of what we now call the "sun belt"; that oil's environmental superiority over coal was appreciated even in the 1920s; and that the petroleum industry already had developed an extensive production and marketing infrastructure from over 40 years of experience in the "illuminating oil" (kerosene) business before it began to compete with coal in the industrial market. Also, Pratt notes that the intense early competition both between coal and oil and within the

oil industry led to inefficiencies in the use of both fuels which became a "legacy of waste" for future generations.

The two articles that follow, by August Giebelhaus and by Arnold Krammer, both provide early historical case studies which will leave the reader familiar with the current Washington frenzy over "synfuels" with an almost haunting sense of deja vu. Giebelhaus reviews "The Case of Power Alcohol in the 1930s," when the concept of converting agricultural produce into motor vehicle fuel was last in political vogue. Giebelhaus's detailed historical review shows why, despite substantial political support, the power alcohol movement of the 1930s was doomed from the start. The names, places, and principal actors may sound familiar; many are back in the news today with identical arguments both pro and con. In his conclusion though, Giebelhaus does note some of the charcteristics that make the contemporary "gasohol" movement different from the 1930s movement: limited domestic petroleum resources, automotive pollution regulations, and an increased emphasis on using agricultural waste rather than food crops as alcohol feedstock.

Krammer's article may be even more germane to recent proposals for massive federal investments to construct giant plants for the production of synthetic oil and gas from coal and oil shale. Krammer recounts the history of America's first coal-to-oil synthetic fuel demonstration plant, built and operated by the federal Bureau of Mines in the town of "Louisiana" in the state of Missouri from 1949 to 1953. The Louisiana project was undertaken in the belief that U.S. national security (in light of the experience of the Second World War) required development of a domestic alternative to imported oil, an alternative which could be provided best by synthesis of liquid fuel from the nation's abundant coal resources. At least according to the Bureau of Mines' estimates, the project demonstrated the feasibility of producing gasoline from coal at a cost (at that time) of less than 11¢ a gallon. Nevertheless, in 1953 the project was terminated for being "uneconomic." The lesson of this story is relevant not only to pending "synfuels" proposals, but to government solar energy programs, which also have been dismissed by some as "uneconomic" in the short term.

The last of the historical studies, by Ethan Kapstein, also serves as an introduction to the solar energy concerns of the book's second half. Kapstein's review of the history of solar energy development in the United States shows that important interest in the practical application of solar energy predates "Sun Day" 1978 by at least three-quarters of a century. Kapstein recalls research efforts on solar