Annual Review of Energy, Volume 1. Annual Reviews, Inc., Palo Alto, California (1976). 772 pp. $15.00.

This initial volume of the new series of *Annual Reviews* is the best compendium of the facts and issues involved in the energy situation in the U.S. and belongs on the desk of every energy analyst. It consists of 28 articles, all prepared by experts in their respective fields. The scope is indicated by the headings for the different sections:

Energy Supply and Distribution: Resources and Technologies
Energy and the Economy
Energy Conservation
Impacts on Environment, Health, and Safety
Energy Policy and Politics.

In addition, there is an overall introductory article by Harrison Brown, bringing up-to-date his world view of energy and its place in society, and an article by Mason Willrich on "International Energy Issues and Options." With the exception of these two articles, Vol. 1 concentrates on the U.S. energy system; it is intended that Vol. 2 will concentrate on aspects and issues of the global energy system.

Brown's article, "Energy in our Future," is well worth reading to gain an overall perspective of the historical place of energy in our society and of the problems and prospects for the future. Brown describes our present situation as an "energy trap," into which we have become ensnared by depending on low-cost oil and gas, fuels that will soon be used up and, in the meantime, are not entirely under our control. With regard to the future, Brown takes an optimistic view, stating that "It now appears that humanity need never suffer from a shortage of available energy."

For more accurate details on the available sources of energy, one needs to go beyond Brown's article. For example, he gives our coal resources correctly as ~1500 billion MT; but to find that <10% of this may be available, one must turn to Schmidt and Hill's article on coal. There one learns that not all tons of coal are equal and that the feasibly usable coal may be further discounted after it has been normalized to a standard Btu content. The amount and quality of coal that is usable is important because coal is commonly regarded as the "swing fuel," most readily available to take up the slack when oil and gas become really scarce and to serve as the interim fuel until the breeders or fusion come on line. With the increased use of coal visualized in most energy scenarios, the difference between 1500 billion tons and one-tenth this amount is the difference between coal lasting several hundred years and becoming exhausted near the middle of the next century. Similar optimism with respect to the geothermal energy source is projected by Brown, suggesting that 40 000 MW of geothermal electricity is possible by 1995. In Kruger's article on "Geothermal Energy," numbers an order of magnitude lower are indicated as much more likely, even with a fairly strong national program.

Speaking of optimism, the article by R. F. Post on "Nuclear Fusion" starts with the stated objective of proving that fusion "offers the best, and perhaps only, long-term solution to the complex set of energy-related problems that man will face in the future." Nevertheless, in discussing visions of fusion reactors, he speculates that "the day when fusion power will first be put to practical use may possibly depend more on finding a 'new invention' than on the patient pursuit of present approaches." If this is true, then two of the so-called symptotic energy sources, solar electric and fusion, depend on the luck of invention if they are to appear in an economic form.

The problem of how we make the transition from the still relatively low cost petroleum and gas to liquid fuels from oil shale or coal and to synthetic gas from coal in an economic way is a common thread to many of the articles. The routes for making this transition involve, directly or indirectly, higher energy costs derived either from an escalation of the price of Organization of Petroleum Exporting Countries (OPEC) oil or from some form of artificially induced price increase. As long as oil is available, it will be cheaper to extract from the ground than it will be to produce it from some other energy resource. The problems of waiting until a world scarcity of petroleum forces us into synthetic liquids and gases are (a) that the transition to a new energy source cannot be made quickly, and (b) the foreign source of petroleum could suddenly be cut off. Perhaps the latter has been made less of a hazard by the recently acquired ability of the OPEC nations to spend all the funds they receive, but the time required to shift from one energy source to another cannot be easily overcome.

Higher energy prices are expected to lead to decreased energy use, but there are also other means of reducing our dependence on increased oil imports. As Schipper points out in his article on "Raising the Productivity of Energy Use," ". . . economic analysis of the physical options for energy conservation shows that saving 30-40 percent of the expected total future energy demand in the United States would be far less expensive than supplying the . . . fuels . . . ."

In a review such as this, it is impossible to indicate even a representative number of the very readable insights to various phases of our energy situation given in this volume. Suffice it to say that this book serves as an adequate encyclopedic source of information to the energy dabbler and should be the initial reference used by the energy researcher.

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The Nuclear Fuel Cycle—A Survey of the Public Health, Environmental, and National Security Effects of Nuclear Power, rev. ed. The Union of Concerned Scientists, The MIT Press, Cambridge, Massachusetts. (1975). $4.95.

Like it or not, contrary views are usually most effectively presented elbows out, so to speak, and this book is no exception. In 1972, the U.S. Atomic Energy Commission

(AEC) issued a report, "Environmental Survey of the Nuclear Fuel Cycle." Dissatisfied with the viewpoint of that document, The Union of Concerned Scientists launched what the Preface calls an "independent, parallel study intended to illuminate defects and important omissions" of the AEC report. The present text is described, rather grandly I think, as "the conclusions of the major technical review that was carried out." What we have, in fact, is a collection of eight essays of quite variable quality; in my opinion, half of them could have been omitted with little loss.

The opening chapter, "An Overview of Nuclear Power," states the central problems of implementing nuclear energy as reactor safety, waste disposal, and safeguards. These in turn imply understanding and solution of the associated technical and managerial problems. The writers believe that the U.S. nuclear program is not adequately dealing with these problems, or in their words, "mismanagement of the U.S. nuclear program has become so pervasive that there are now serious questions as to whether the nation can, in fact, manage such a technology with the required care . . . the technical and managerial issues must be fully resolved and the construction of new nuclear plants must be restricted until this is accomplished." The purpose of the book is then "to set forth the technical problems in the nuclear program so as to help move toward that full public understanding which is at present lacking." The book falls far short of this aim, in my opinion.

Of the seven remaining chapters, I thought the best was on the problems of storage and disposal of high-level radioactive wastes by Thomas C. Hollocher of Brandeis University. My only objection is that he fails to point out the difference between the *toxicity* of plutonium and the *hazard* therefrom. Aside from that, I thought the essay a sound general discussion. The chapter entitled "Catastrophic Nuclear Reactor Accidents" was an interesting but incomplete discussion on the loss-of-coolant accident. Unfortunately, the authors of this chapter (Daniel F. Ford and Henry W. Kendall) preferred to spend more time on the spectacular features of the accident than on a balanced presentation of the issues. The reader gets no impression of the defense-in-depth philosophy of both reactor design and operating practices that make a core meltdown in a commercial power station an extremely improbable event, nor of the extent of experimental and analytical reactor safety research. The chapter left me with an impression not of an attempt to inform, nor even of advocacy, but of propaganda.

The remaining chapters are of descending interest and quality. I found the chapter on safeguards reasonable in tone but not very informative. The reader already knows that safeguards problems exist; if he wants to know what is being done about them and if the measures are likely to be effective, he won't find out here. The discussion of fuel reprocessing is obsolete because of its concentration on the dead issue of the original West Valley Plant; it should have been rewritten or omitted. The chapter on radioactive wastes suffers from a different deficiency. The author has chosen to create a dubious issue out of his own notions of the possibility of cesium release, and the major concerns of research in this field are never presented. The chapters on mining and milling hazards are likewise unconvincing. The historical discussion of the gradual recognition during the 1920's and 1930's of the connection between an unmistakably high incidence of lung cancer and airborne reactivity was interesting. However, I was more concerned with *present-day* mining conditions and the adequacy of *current* regulations. I found the discussions of these matters vague; to lower current dose rates by a factor of 100 at a cost of $2 million per mine seems to me a gross distortion of priorities on the basis of the evidence given. The demands for "remedial action" concerning uranium mill operations appear equally ill-founded.

In sum, the pretentious claims of the opening chapter are simply not fulfilled, and very little has been contributed toward that "full public understanding" of which the authors spoke.

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About the Reviewer: Melvin Tobias, a long-time contributor to Nuclear Science and Engineering *as author, referee, and book reviewer, now serves as an Associate Editor. As with all other information in* Nuclear Science and Engineering, *opinions expressed in this review are entirely those of its author and do not necessarily represent the views of this Journal, the American Nuclear Society, or the Oak Ridge National Laboratory.*

Stress Transients in Solids. By John S. Rienhart. Hyperdynamics, Santa Fe, New Mexico (1975). 230 pp. $8.95. Paper.

This book presents an introduction to the fundamental aspects of elastic wave propagation. The text is well illustrated, and the mathematics level is not too advanced. The wave equation is derived in detail, but most other equations and solutions are stated without proof. The physical significance of the various mathematical relations are discussed in detail.

The subjects covered include definitions of stress, linear strain, the generalized Hooke's Law, derivation of the wave equation, spherical and cylindrical waves, surface waves, and momentum transfer. Much attention is given to boundary effects. These include normal and oblique incidence, reflection, corners, notches, and spalling.

A brief discussion of experimental procedures is included, but other important topics are omitted. Among these are elastic-plastic waves, visco-elastic materials, and numerical analysis methods. An adequate bibliography is included but contains no specific references on the latter topic. The book would be useful in an introductory course where the professor supplies the missing mathematical rigor.

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