Book Reviews

Energy, The Conservation Revolution. By John H. Gibbons and William U. Chandler. Plenum Publishing Corporation, New York (1981). 258 pp. $17.95.

Energy, The Conservation Revolution is a semipopular book extolling the virtues of energy conservation. It is written from the twin points of view of the environmentalist and the conservationist. It makes the case for energy conservation very well, and is not only easy to read but also the style is quite informal in many sections. In fact, if I had to give a popular lecture on energy conservation, I could do no better than to plagiarize whole paragraphs from the book. But the book is more than just a tract promoting conservation; it contains a great deal of information on the art of energy use forecasting, the costs and environmental effects of various energy sources, the probable supply to the year 2000, and, of course, the many opportunities for energy conservation. To the credit of the authors, the sections giving factual information are constructed with a scientist's regard for the truth, or what passes for truth in this area, even when it provides only weak support for some of the positions being taken.

From the point of view of the book, the excessive use of energy is wrong because

1. There are always bad environmental effects associated with energy's use.
2. Excessive use of petroleum by the U.S. drives up its cost and thus makes it unavailable to the poor in the third world. Also, by importing petroleum we deplete the supply of oil that could be used to help developing countries improve their lot.
3. At present energy prices, it is more cost effective to undertake conservation measures than it is to develop new energy sources.

Natural gas is the energy source of choice because it is most acceptable environmentally and because the authors believe that there may be a great deal available from unconventional sources, such as geopressured aquifers along the Gulf coast, Devonian shale in the East, tight sands in the Rockies, and in coal seams. Furthermore, the price of gas is relatively low. Coal is frowned upon because of its bad environmental effects, and, although it is admitted that large scale use will be necessary, such use should be controlled as much as possible. Strip mining should be avoided, in the Appalachians because of the difficulty of preventing ecological damage in hilly country, and in the West because water for reclamation is lacking. Electricity generation is not favored because it is expensive (per Btu of electric energy) and because it is considered wasteful on thermodynamic grounds. (See more on this below.) One might expect a book with a strong environmental leaning to promote solar energy, but cost considerations limit the favored solar applications to burning wood waste and growing moderate amounts of other biomass. Nuclear energy is treated neutrally. Although it is shown as being much more benign environmentally than coal, mention is made of the possibility of catastrophic accidents and of the fact that one-third of the population opposes it.

The authors strongly favor cogeneration, i.e., the simultaneous production of process heat and electricity from the same heat source. Cogeneration uses less primary energy and costs less overall than providing heat and electricity separately. There have been traditional barriers to cogeneration in the past. Chemical companies raise their capital in a different way than utilities and expect a higher return on their money, and it is a bother for utilities to accept electricity from sources that they do not control. Furthermore, although the total cost is lower, there has been the problem of cost allocation between heat and electricity. These barriers are now being overcome, due in large part to the efforts of conservationists such as the authors of this book. Their efforts along this line are certainly to be applauded.

The desirability of energy conservation is universally acclaimed, although not for all of the reasons cited in the book. One gets the impression that energy use is regarded as an evil thing, whereas some of us attribute most of the good things of modern life to the freedom that the use of energy resources has given to the average man. Thus, the lead sentence in the section on *The External Costs of Energy*, "It is a fact that many thousands of people die each year from our use of energy," seems a little heavy handed. Other examples of this viewpoint could be cited.

As stated in the Preface, the book is not intended to cover the whole energy problem, and it doesn't. Some of us see our crucial energy problem as that of obtaining a sufficient supply of liquid fuels. The recommended conservation measures will certainly help, but will not solve the problem, and some source other than petroleum must be found. The book seems to frown environmentally upon essentially all such proposals.

With regard to the poor marks given to electricity generation, not enough credit is given to the convenience and superior value of Btu's in the form of electricity. A study by Calvin Burwell now going on in the Institute for Energy Analysis is finding that, even in the field of heating houses, electricity is more valuable than was the conventional wisdom when the book was written. The standard view, adopted by the authors, was based on some data on the energy used for gas heating, coupled with the pure assumption that gas heating of homes was 70% efficient. The actual efficiencies achieved were much lower than this, and a re-evaluation of the available data suggests that it takes two to three times as many Btu's of fossil fuel to heat a home as it takes of Btu's in the form of kilowatt hours. Thus, the greater convenience and effectiveness of electric heating to a large extent makes up for the

thermodynamic energy loss at the electric generating station. Thus, comparing coal, oil, and electricity on the basis of cost per Btu of contained energy puts electricity at an unfair disadvantage.

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About the Reviewer: H. G. MacPherson, now in semi-retirement, is a chief scientist with the Institute for Energy Analysis at Oak Ridge Associated Universities. Dr. MacPherson had a long career in research with the Union Carbide Corporation beginning with National Carbon and concluding as deputy director of the Oak Ridge National Laboratory. His academic training was at the University of California, Berkeley.

Transitional Energy Policy 1980-2030 Alternative Nuclear Technologies. By Hugh B. Stewart. Pergamon Press, New York (1981). 266 pp. $12.50 paperbound. $30.00 hardcover.

This book's title appropriately identifies its purpose and even gives a reasonable description of its material content. Starting with a summary of various projections of total energy requirements for the future and the methods used in their determination, the author continues by briefly describing the contributions that might currently be expected from various energy sources; not surprisingly (and with the full concurrence of this reviewer) the nuclear option appears to be a "must." The author then gives an economic analysis of various nuclear strategies and technologies which might be employed. What he considers the "prevalent strategy," and this at present energy demand growth, is the "once-through" fuel cycle with present price structures militating against recycle programs involving plutonium and ^{233}U (from thorium). A "not-so-prevalent-strategy" assumes a less-rapid energy demand growth with a consequently greater need for plutonium and ^{233}U, even though these are weapons materials. In addition to considerations of technology (and economics), some attention is also given to public acceptability of nuclear power as well as the administrative patterns used commercially, some successful and some less so.

In the appendix is an outline of the bases for the logistics of the energy growth projections used along with the neutron-economic bases for some of the fuel cycles described. These appear adequate.

Considering his self-imposed restraints and the limitations of his data, the author seems to have treated his material competently. However, as stated in the Preface, the work was essentially completed in early 1980, and many of the projections used were published earlier. Unavoidably, and this is mentioned, long-term projections of this type are usually very poorly fulfilled; hence, one might question the usefulness of any 50-yr prediction. This general problem is particularly significant today, at a time of rapid and radical change in both the perception and actuality of the energy picture, especially from an economic viewpoint. The effects of such recent factors as current exorbitant interest rates and the changing availability of oil may be difficult to foresee, even for as short a period as two years; however, as perturbations of an overall picture, they might be "cranked into" the analyses to give some sort of "current" picture.

This reviewer considers it a major failing that in such a volatile situation, no attempt was made even to consider various alternatives, especially the radical possibilities that might form "boundaries" of some aspect of actuality. For example, brief treatments might have been given to the two rather extreme possibilities of public acceptance of the nuclear option. First, the anti-nuclear pressure could be assumed so successful as almost to preclude operation of current power reactors, much less encourage additional construction. At the other extreme, the nuclear option could be treated as a normal energy source with members of the general public realizing that actual reactor hazards do not support the current violent anti-nuclear propaganda. Either view seems unrealistic, but probably not much more so than is continuance of the status quo which is the only possibility considered.

Overall, the book is somewhat useful, principally as an analysis of where nuclear energy is today and possibly will be in the near future of up to a decade. As far as being useful for a long term, much less 50 years, this reviewer doesn't see that in the cards. It is hard to recommend the book for personal use by anyone, though copies for libraries might be recommended.

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About the Reviewer: Hugh Henry is now professor emeritus in physics at DePauw University where he was chairman of the department for a score of years. Between that activity and other academic experiences, he was responsible for health physics and nuclear criticality safety at the Oak Ridge Gaseous Diffusion Plant. Dr. Henry completed his graduate studies at the University of Virginia.