timely that authors James Duderstadt and Chihiro Kikuchi offer their excellent book, *Nuclear Power: Technology on Trial,* as a contribution to understanding the issues of nuclear electric power generation. The book is directed to the interested layperson; truly that broad group must come to appreciate the issues relating to this subject if rational decisions are to be made. The book goes far toward that end. I commend it to the broadest audience as a most worthy factual presentation.

Duderstadt and Kikuchi explore first whether or not nuclear electric power generation is a necessary part of the national and world energy picture, exploring the identifiable alternative energy sources as well as the prospects for conservation. Then they trace the development of nuclear power and explain the basic concepts of the technology. The authors next treat the social, economic, and environmental questions of nuclear electric power generation and discuss the details of the nuclear fuel cycle and the international aspects of the subject. The final chapter describes breeder reactor and nuclear fusion technology to complete the picture of nuclear energy sources.

The exposition is accompanied by numerous references to resource materials and the book contains a useful bibliography that provides readers with guidance to further study. An index of over 400 entries completes the book and facilitates its use as a resource. *Nuclear Power* is a useful, timely, scholarly contribution to rational debate of the question of how this country shall approach its energy future. A tribute to the care with which the authors prepared this book is the nearly complete absence of errors of any kind—typographical, logical, or technical.

But I must express some pessimism as to whether this book will truly accomplish its purpose. The facts are in the book. The authors have eliminated technical jargon as much as possible, but have adopted a scholarly style, which is natural to them and to those trained in scholarly inquiry, though unfamiliar to the "interested layperson." Furthermore, the gulf in understanding that separates the majority of concerned people from those who comprehend the technical matters is very great. The arguments require quantitative evaluations, that is, they depend on numbers and appreciation of what the numbers mean. The task of providing knowledge and perspective across this gulf to this large group is very difficult on this account, and I suspect has not yet, even with this excellent book, been accomplished.

The authors admit their bias toward nuclear electric power generation, being as they are a part of the nuclear community. The book takes a softly positive attitude toward the prospect, but is an honest presentation of the case.

It seems useful to make a few points not made in the book and to emphasize some that are.

Some people doubt whether an energy crisis really exists. There is not a present crisis in energy availability; there is a real foreseen crisis. Petroleum supplies are now adequate but certainly limited at some level; studies indicate the central point that production can keep up with demand only for another decade or so. What we are now experiencing is the result of observance of this fact by producers and refiners. United States oil companies and OPEC nations, without explicit admission, pursue the policy of conserving their own resources until prices are higher, while still producing for the present market. At the same time, capacity is not likely to be expanded much beyond its present level. This is because the economics of new facilities are such that new capacity and replacement plants must be planned to operate for several decades, a time longer than the petroleum resource is foreseen to last. Therefore, we are now entering a time of reduced growth, and the present petroleum energy crisis is one of the reduction of the growth rate of petroleum energy use. There is pain in adjusting to a change in growth rate, as there will be pain in adjusting to diminished supplies, which can be reduced by appropriate planning against the foreseen limitations. The crisis in actual petroleum energy availability is yet to come. (Some petroleum will always be available at some high price.) This is the only important point that is not made strongly in the book.

An important point made in the book but somewhat obscured is that the hazards of nuclear electric power generation are relatively well known and therefore arguable, while the hazards of conventional alternative electric power sources are not so well known but nevertheless accepted. Another point is that the connection between nuclear electric power generation and nuclear weapons or their proliferation is somewhat tenuous, even though these are equated in popular opinion.

Mechanisms for public input into decisions relating to nuclear power generation have from early times been a part of the U.S. program for nuclear energy development, a part of a general modern-day trend. The fact that this is not so much true in the case of the alternative energy technologies has led some concerned people to become involved in nuclear power issues in an expectable role as adversaries against the industrial and government proponents. This has had a general highly beneficial effect, but the opportunities for intervention have led to some unfortunate excesses.

Those with interest in the subject of nuclear electric power generation, and the related technical and social issues, should read Duderstadt and Kikuchi's *Nuclear Power: Technology on Trial.* The book is certainly within reach of readers with some science background, and the effort to take in and digest its contents will be richly repaid.

John M. Carpenter is a senior physicist at Argonne National Laboratory (ANL), where he serves as technical director of the Pulsed Neutron Source Program, and is responsible for the research and development activities. The Intense Pulsed Neutron Source IPNS-I, recently completed, is a new, accelerator-based type of source for basic materials research using slow neutron scattering and fast neutron damage techniques. Dr. Carpenter came to ANL in 1975 after initiating developments there on the pulsed spallation neutron sources in 1971, constructing the world's first prototype of such an instrument in 1974 and its successor in 1977. After receiving his degree in 1963, he became professor of nuclear engineering at the University of Michigan, where he pursued neutron scattering, neutron thermalization and instrument development research, and taught nuclear reactor physics, nuclear instrumentation, and reactor measurements courses.

Nuclear Power: Technology on Trial

Author	James J. Duderstadt and Chihiro Kikuchi
Publisher	The University of Michigan Press, Ann Arbor, Michigan (1979)

Pages 228

Price $16.00 hardcover; $8.50 in paperback

Reviewer Gregory R. Choppin

In this relatively small book, the authors attempt to discuss the issues involved in nuclear power. They admit in the Preface to a pronuclear bias and avoid "merely listing without critical comment the familiar pros and cons of this well-worn debate." They present the issues through scientific analysis, aiming at an open-minded layperson.

The fundamentals of reactors, fuel cycles, risk analyses, waste disposal, and advanced systems such as breeder and fusion reactors are described at about the level of *Scientific American*. In each case a discussion and analysis of the objections related to each aspect of nuclear power is then presented. Several times the authors express their conviction that many of the nuclear opponents are more broadly anti-technology and wish "to force our society back to a simpler way of life in which dependence on technology is minimized."

A remarkable amount of relevant scientific data is offered to refute seemingly all the antinuclear arguments, large and small. In general, the style, the order of presentation and the technical level are consistent and easy to follow. Certainly, there is a great deal of value in this book for anyone seeking to refute the antinuclear arguments. Sometimes the authors seem to assume only bad faith by nuclear opponents but, for the most part, they are successful in their attempt to present unemotional scientific analyses. Obviously, as one jury in the trial of the technology of nuclear power, they return a clear verdict of not guilty.

Gregory R. Choppin received his PhD from the University of Texas and after a post-doctoral period at the Lawrence Radiation Laboratory, Berkeley, joined the faculty of Florida State University where he is professor of inorganic and nuclear chemistry. He has spent a year at the Center of Nuclear Research, Mol, Belgium (1963) and at the Institute for Transuranium Elements, Karlsruhe, Federal Republic of Germany (1980). He is the author of approximately 100 articles in nuclear and radiochemistry and of three books. At present he is a member of the technical review committee for the Chemistry Technology Division of Oak Ridge National Laboratory. He has served as chairman of the Division of Nuclear Chemistry and Technology of the American Chemical Society and is chairman of the Subcommittee on Radiochemistry of the National Research Council.

The Technology of Controlled Nuclear Fusion

Editors J. R. Powell and C. T. Eterno

Publisher U.S. National Technical Information Service (1978)

Pages 1928 (2 volumes)

Price Printed $19.00; Microfiche $3.00 each volume

Reviewer Mark A. Prelas

The *Proceedings of the Third Topical Meeting on the Technology of Controlled Nuclear Fusion* is a two-volume text that is ideal for the expert and student alike. Since the text was derived from the meeting of the same title, it consists of many papers, written by some of the world's foremost experts, which review specific areas in fusion technology. (Altogether, there are 141 papers.) The text is divided into 13 chapters, each dealing with a general subject (i.e., national programs, advanced fusion concepts, nonelectric applications, blanket engineering, fusion reactor design, economics and system studies, fusion materials, engineering technology development, tritium handling and fuel cycle technology, plasma engineering, environment and safety, operation and maintenance, and fusion reactor engineering and technology). One must commend the editors, J. R. Powell and C. T. Eterno, for organizing the 141 papers in this manner. Additionally, the authors of the papers must be congratulated for the generally excellent presentation of the subject matter.

Perhaps the most impressive feature of the text is the sheer volume of fusion research discussed. Despite the complexity of the technology, one must feel content with the progress made thus far. Indeed, one clear message from the text is that much of the effort, which thus far has been involved with the physics of the problem, will soon be shifting toward engineering and technical development. In light of the many engineering problems that must be addressed (e.g., blanket engineering, materials, tritium handling, safety, and operation and maintenance), the text is able to pinpoint specific issues that researchers may find valuable in the developing programs to take advantage of this shift in emphasis.

Particular sections that should be noted are Non-Electric Applications; Blanket Engineering; Panel on Fusion Materials; Tritium Handling and Fuel Cycle Technology; Environment and Safety; and Operation and Maintenance. In these chapters, many of the engineering problems that require further research are discussed. For instance, how does one design the reactor so that it can breed tritium [from $^{6}Li(n,t)\alpha$ or $^{7}Li(n,n't)\alpha$] to replenish the atoms consumed in the deuterium-tritium (D-T) reaction, survive a wall loading of $\sim$1 MW/m^2, possibly breed fissile materials (e.g., $^{233}U^{-}$ or ^{239}Pu) from fertile materials (e.g., ^{232}Th or ^{238}U), and produce a useful energy source (chemical or electrical). In order to accomplish these tasks, many issues must be explored in more detail. This list includes the short- and long-term material problems (in the areas of alloy development for irradiation, performance, damage analysis and fundamental studies, plasma material interaction, and special purpose materials) discussed by Zwilaky et al.; techniques for handling the 6- to 12-kg tritium inventory envisioned in a commercial D-T fusion power plant; environmental and safety issues with the tritium, superconducting fusion magnets (in magnetic confinement systems), lithium handling, etc.; and the operation and maintenance problems associated with blanket replacement, magnet servicing, disconnecting the coolant lines, etc. In addition to the excellent presentation on engineering and technical problems, a valuable discussion on nonelectric applications