

Energy Technology. By Tokio Ohta, Elsevier Science, 1994: 234 + x pages. Hardbound price: U.S.\$59.00.

This book is radically different from the usual run of scores of engineering texts on energy in that it deals with fundamental principles rather than with technology hardware and the treatment of the fundamentals is comprehensive in scope and detail and amply supported by mathematical equations.

The text is presented in five chapters devoted to energy sources, conversion methodology, evaluation, systems-technology and frontier conversion developments, in logical sequence.

The "energy problem" as we see it today is an amalgam of three main issues: demand escalation, resource depletion and environmental deterioration, all of them related to the use of fossil fuels as the mainstay of energy production. Mitigation of these issues calls for an altogether new multi-disciplinary approach, embracing not only science and technology but also economics, sociology and politics. The book under review represents a splendid effort in this direction and its appearance is most timely and relevant at the present stage of transition in energy technology from the traditional to non-traditional pathways.

The first chapter provides a broad review of the physical principles underlying the concept and phenomenology of energy, its sources, forms and applications. The presentation is comprehensive and complete both in its scientific content and in factual details. It covers classification of energy in different ways, resource estimates and geographical distribution, and modes of utilization for energy production. An interesting, rather unusual feature is that energy production in biosystems is also included in this review.

Processes of energy conversion from various initial primary and secondary forms to desired end-use forms are discussed in the second chapter. Apart from familiar forms, less common ones like thermionic and thermoelectric phenomena and their practical utility potentials are also discussed. Special attention is given to the conversion of solar photon energy. The treatment of various transformation methodologies is such as to inspire development research in these non-conventional areas.

In the next chapter on evaluation of energy, the author introduces the concept of "quality of energy" which he uses for the comparative ranking of different forms of energy. Two kinds of evaluation of energy systems are discussed: one, based on thermodynamic principles with extensive application of energy analysis, apart from energy estimates; and the other based on economic considerations.

The importance of cost, both to the supplier and to the end-consumer, in determining the choice of energy resource or conversion process for a given purpose, cannot be overemphasized. Costing procedures are discussed thoroughly for different forms of primary and converted energy (including solar and other forms of natural energy), giving due weightage to environmental consequences.

The most substantial part of the book and one of practical relevance to energy users is the fourth chapter which deals with the totality of energy systems comprising all the component subsystems, extending from the search for primary sources to their transformation, transmission and utilization. The coverage is comprehensive, leaving out practically nothing concerning energy and its fall-out. However, the main focus of attention is on energy transfer, conversion, storage and consumption. Importance is given to solar hydrogen energy systems and to fuel cells, though their practical realization may belong to the future.

The last of the five chapters looks to the future, beginning with a brief review of the constraints and guidelines for the future course of energy development. The constraints derive from global environmental concerns and the depletion of the currently used terrestrial energy resources, particularly petroleum and uranium fuels. The guidelines stem from thermodynamic considerations which call for entropy reduction and minimal entropy production in the entire chain of energy processes right from production to end-use. The main driving forces for innovative reforms in energy systems (technical, environmental and economic) are reviewed and illustrated with examples from the hydrogen energy system and refrigeration technology. The historical trend towards higher energy density and higher efficiency is illustrated with a review of the important landmarks of energy innovations and developments in the past three centuries.

As a tailpiece, a set of useful tables of important physical constants and inter-unit conversions is appended.

In summary, this book will serve as a useful text to a wide cross-section of readers, particularly energy researchers, engineers, economists and environmentalists interested in future energy development.

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