



BOOK REVIEWS

Energy and Exergy Currents (An Introduction to Exergonomics) by E. I. Yantovskii, Nova Science Publishers Inc., New York, 1994. ISBN 1 56072 175 8. 183 pages, hard bound. Price: U.S. \$69.00

As stated in the author's Preface, this book is mostly a compilation of the lectures delivered by him at international conferences on energy during 1991–1993. In many respects, it is an unusual work—unusual in content and unusual in presentation. Important issues in contemporary thermodynamics are addressed in an interest-sustaining and thought-provoking manner.

The main thesis of the author is that exergy is the absolute resource that should be conserved and that exergy analysis is the most important tool for analysing at least some of the urgent problems of atmospheric pollution. The author suggests that the specific exergy consumption should be the target function in optimization calculations for future energy projects.

A new term, "exergonomics" has been introduced to underline its similarity to conventional economics. We are already familiar with the expression, "ergonomics" to denote the economics of energy transactions.

The first chapter is mostly a tribute to the views and thoughts of the nineteenth century Russian thermodynamicist N. Oumov, who seems to have influenced the author's thinking on the subject a great deal. Energy is considered as something that defies translation in plain terms, although the effects of energy flows are experienced physically and can even be measured and quantified. The so-called energy forms and types, such as kinetic, chemical, thermal, mechanical, nuclear, etc., are perceived as "energy carriers" for the elementary processes occurring within the energy source.

The main energy sources of the planet, at present as much as in Oumov's time, are substances endowed with high chemical potential. They are fuels which need to be mined and delivered to the conversion devices. The notoriously low efficiency of conversion processes and the enormous wastage of energy sources has been recognized with remarkable foresight by Oumov. The need to turn to an alternative, non-terrestrial energy source, such as the Sun, is obvious. With proper conversion technology, solar radiation can meet all of the energy needs of the world for all time to come.

Chapter 2 introduces the concept of exergy and Chapter 3 develops expressions for exergy efficiency. The analysis of "exergy allocation of fuel consumption" in a cogeneration plant is novel and elegant. Figure 3.4 is an elegant summary of the results of the analysis.

Chapter 4 is all about exergonomics. The principles and applications of exergonomic analysis are explained with the help of informative drawings. Worth special mention are those expressing the variation of specific exergy consumption on second law efficiency, the historical trends in second law efficiencies in various industries, the exergy current diagram for the total energy supply in the U.S.S.R., and the quantification of expenditure optimization on technological safety measures.

Chapter 6 contains a wealth of information that is of considerable interest to scientists as well as engineers. Renewable energy sources are examined in Chapter 5. Exergy and energy flows have been carried out for solar ponds, electrical heaters, clean power cycles and MHD generators using coal combustion in oxygen. They are shown to have considerable promise as solutions to the problem of clean energy. The primary idea in these cycles is that the release of harmful exhaust gases can be eliminated by excluding nitrogen before the combustion of the fuel. The thermodynamic analysis of the cycles is elegantly done using thermodynamic diagrams. The graphical comparison of the estimated efficiencies of the different schemes as a function of their operating temperatures is highly interesting as is also the equation for the efficiency enhancement due to chemical recuperation.

The Greenhouse effect is also analysed quantitatively using exergy concepts. The author presents a reasonably optimistic picture about setting worldwide targets on CO₂ abatement and suggests interdisciplinary studies for achieving the targets. He recommends the COOPERATE (CO₂ prevented emissions recuperative advanced turbines energy) cycle as one that would be really clean with zero emission and high thermodynamic efficiency. Figure 7.9 presents a thermodynamic diagram of the cycle and should be examined closely, especially by mechanical engineers.

A surprising number of engineering problems are also identified for serious consideration. The book is a mixture of perspective and detail. It deserves serious study by engineers and scientists alike.

In short, the book is a goldmine of new ideas and thoughts in modern thermodynamics, but one should be prepared to break through the tough rocks of Russo-English to reach the treasure. A glossary of the rather unconventional nomenclature and symbols used by the author is provided at the beginning of the book. This is indeed a help to those who are accustomed to Anglo-American texts.

M. V. C. SASTRI
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