

**Energy: Technology and Directions for the Future**, by John R. Franchi. Academic Press, 2004, 491 pp., ISBN: 0-122482-91-3

**REVIEWED BY: SAEID MOKHATAB<sup>1</sup>**

Energy demand is expected to grow in the 21st century as more countries seek a better quality of life for their citizens. *Energy: Technology and Directions for the Future* presents the fundamentals of energy for scientists and engineers. It is a survey of energy sources that will be available for use in the 21st century energy mix. The reader learns about the history and science of several energy sources as well as the technology and social significance of energy. Themes in the book include thermodynamics, electricity distribution, geothermal energy, fossil fuels, solar energy, nuclear energy, alternate energy (wind, water, biomass), energy and society, energy and the environment, sustainable development, the hydrogen economy, and energy forecasting. The approach is designed to present an intellectually rich and interesting text that is also practical. This is accomplished by introducing basic concepts in the context of energy technologies and, where appropriate, in historical context. Scientific concepts are used to solve concrete engineering problems.

The selection of topics is designed to provide the reader with an introduction to the language, concepts, and techniques used in all major energy components that are expected to contribute to the 21st century energy mix. This book presents the fundamentals of energy production for engineers, scientists, engineering professors, students, and anyone in the field who needs a technical discussion of energy topics. It provides engineers with a valuable expanded knowledge base using the U.S. National Academy of Sciences content standards and examines the energy options for the 21st century as older energy sources quickly become depleted. A detailed Instructor's Guide is also available to qualified instructors.

This book can serve as a useful reference because it collects equations and other information from several branches of engineering and science in one book. Many illustrations, tables, appendices, references, and an index are provided to help the reader. Exercises for each chapter are designed to help the reader understand concepts and apply the material to realistic situations.

The history of energy consumption and fundamental definitions of energy are introduced in Chapter 1. The generation and distribution of electric power are discussed in Chapter 2. The laws of

thermodynamics, heat engines, and heat exchangers are discussed in Chapter 3. Chapter 4 describes the Earth and geothermal energy. The origin, distribution, and availability of fossil energy are discussed in Chapters 5 and 6. Active and passive solar energy and solar electric technology are described in Chapters 7 and 8. Background concepts for nuclear energy are presented in Chapters 9 and 10 (mass–energy transformations and nucleosynthesis), followed by a discussion on nuclear fission energy and nuclear fusion energy in Chapter 11. Alternative energy sources that rely on wind (wind energy) and water (hydropower, wave energy, tidal energy, ocean thermal energy) are discussed in Chapter 12. Bioenergy and synfuels are discussed in Chapter 13. Relationships between energy, economics, and the environment are considered in Chapter 14. Hydrogen, fuel cells, the hydrogen economy, and energy forecasts for the 21st century are reviewed in Chapter 15.

If you work in an engineering field you will find many of the equations familiar. The technical level of presentation presumes that readers have completed college level physics with calculus and mathematics through calculus of several variables. This level of mathematical preparation may appear intimidating to some, however most of the exercises require minimal mathematics, and much of the more advanced mathematics is used to present supplementary material. Even if you choose not to spend much time with the equations this text gives an excellent basic understanding of the various fields related to energy production and use.

This book presents a balanced look at the various types of energy as well as some subjects you may not have identified as energy related before reading this book. Some readers may quibble over the choice of topics. For example, the chapter on nucleosynthesis presents an introduction to cosmology that may be academically interesting but could be omitted from an undergraduate course. I recommend the book for anyone working in an energy related field who would like to get a better understanding of another part of the field or the subject of energy as a whole. Working engineers who would like a reference that crosses subject boundaries and collects important information about many of them in one place will find this book a useful reference. Educated readers who may not care about the equations presented, but still want a somewhat in-depth look at the subject of energy in its various forms and the problems faced to provide it can still get a good general understanding of the various forms of energy from this book. Students of any engineering or science discipline, who would like a good understanding of the various forms of energy, their production, and use, will find this book easily readable and immediately useful. Overall, this book may prompt you to do further research into one or more of the topics covered here.

<sup>1</sup>Advisor of Natural Gas Engineering Research Projects, Chemical & Petroleum Engineering Department, University of Wyoming, Laramie, WY 82071.