most examples are based on Madison, Wisconsin, can be misleading when a technology is much better suited for a different climate. For instance the ice-maker–heat-pump storage system in Section 7.9 should have been illustrated with an application where heating and cooling loads are more nearly balanced. In some cases I would like to see references to the literature to show where certain models, figures, tables come from; e.g., in Section 3.5.5 a reference for the magic degree day formula, and in Chapter 11 a reference for the variation of fuel consumption with speed. The only explicit error that I have found is an obvious oversight in Fig. 12.4.8 (same intercept for all collectors, regardless of the number of cover plates).

To conclude I would like to complement the author on an admirable job. The book is highly recommended, both as a reference for practicing engineers, and as text for advanced undergraduate or graduate students.

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Energy Management Principles, by Craig B. Smith, Pergamon Press, 1981, 493 pages, hard cover price: $49.50, soft cover price: $29.50.

According to the author, "The purpose of this book was to delineate certain general principles of energy management, explain their basis in terms of basic engineering theory and fact, and then illustrate their use in a variety of situations. The audience for the book was considered to be senior, graduate, or practicing engineers or architects." Energy management is taken to include "load management, efficient end-use, fuel conservation, heat recovery, and more efficient processes and equipment."

The book is organized to clearly take the reader through the steps of an energy management program, with emphasis on programs in commercial buildings (not houses) and industry. Chapters 1–4 describe initial activities, including management commitment and identifying the principles of energy management. These principles, as listed in Table 3.2, start with a review of energy use data and energy audits, continue on to housekeeping and maintenance, follow with an elaboration of the major elements of energy management cited in the foregoing, and conclude with economic evaluation.

Guidelines for building and site energy audits are discussed in Chapter 5. This chapter, like many that follow, does not include sufficient technical material to fully train someone to identify or correct energy management problems. But it serves a valuable role at the supervisory level, by listing important survey items (HVAC, boiler and steam lines, material transport, furnaces and ovens, to name a few) and providing sample survey forms and lists of appropriate instrumentation. The author also includes a table of "energy management opportunities," a very general list that helps answer the question of "have I overlooked any major routes to reduce energy use?" For steam systems, for example, the opportunities include preheating feedwater and combustion air, insulating lines, and recovering stack heat.

Chapters 6–12, the "problem solving" section of the book, provide the reader with information needed to understand and quantify the general principles and opportunities identified in the first five chapters. The chapters cover, among other topics, heating and cooling, electrical loads and lighting, and process energy. Each chapter is well organized and written, and includes tables of general principles (optimize HVAC capacity; do not condition unoccupied spaces; employ heat recovery) and a section on specific energy management opportunities ("a 5°C reduction in condensing temperature can save 10–20 percent on chiller energy use.") The reader will not learn how to perform a first or second law analysis of a chiller, but will see a pressure-enthalpy diagram and learn of possible improvements on each leg of the thermodynamic cycle.

These chapters include many excellent tables which make the book a valuable reference. Table 8.13, for example, compares incandescent light sources with such alternatives as fluorescents, mercury vapor, metal halide, and high-pressure sodium and provides wattage, lifetime, and output. Table 12.5, in the chapter that focuses on economics, is a succinct summary of the formulas used in economic analyses.

The book concludes with tips for assessing and sustaining an ongoing energy management program, and for applying the same principles used for buildings and industry to cities as well. Appendices include conversion factors, energy content of fuels, and power and energy measurement techniques.

For the practicing engineer or architect involved in energy management, this book is an excellent guide and reference. As a text for students, it should not be used alone, but could well supplement material found in more fundamental treatments of thermodynamics, HVAC equipment and electrical systems.

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Wind Power Plants – Theory and Design, by D. LeGourieres, Pergamon Press, 1982, 285 pages, price: $28.00.

The realization that fossil fuel supplies are not inexhaustible and that the use of these fuels can cause environmental damage has created an interest in the use of renewable energy sources. Among these renewable sources, wind energy appears to have the greatest potential for producing high-grade energy at a reasonable cost.

The apparent simplicity of wind power devices is, however, quite misleading. While it is very easy to extract some energy from the wind, it is very difficult to extract large amounts of energy at an acceptable cost.

Wind Power Plants – Theory and Design gives an insight into some of the problems of extracting wind energy. It describes the characteristics of the natural wind, the theory of the design of wind power plants, and describes some of the important parameters. The book also describes many of the solutions that have been used to solve the problems.

There is a comprehensive treatment of the characteristics of the natural wind and also of the aerodynamic characteristics of the generalized and the specific wind power plants. The book describes the theory of the design of wind power plants from the basic power extraction element through to the final power conversion in a manner that is readable by the amateur and useful to the expert.

One important weakness is that the influence of structural dynamics on the life expectancy of the wind power plant is not stressed. While a full treatment of the structural dynamics is beyond the scope of the book, the wrong choice of structural stiffness can cause the failure of an otherwise excellent machine and hence the designer should see this fact emphasized.

Many different wind power plants of the past, the present, and the future are described, hence the book is a useful source of information on these machines.

The book is an excellent reference source for both the amateur and the professional and would serve as a useful addition to a personal library.

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Principles of Engineering Economic Analysis, 2nd Edition, by J. A. White, M. H. Agee, and K. E. Case, John Wiley & Sons, New York, 1984, 546 pages, price: $32.95.

A necessary requirement for the success of a solar energy system is economic viability. Hence it behooves the solar energy researcher to have at least some understanding of economic analysis. Many of the standard solar energy texts (e.g. Kreith and Kreider; Duffie and Beckman) do contain a chapter on economic analysis. But for lack of space such discussions are quite limited, geared to solar applications, and they do not offer a systematic exposition of general principles or a discussion of special topics such as the effect of uncertainties. Some readers may want to learn more about economic analysis, and they may well turn to the book by White, Agee, and Case.

Most of the book (the first seven chapters) is intended as an introductory text at the sophomore level, while the remaining two chapters contain more advanced material. Chapter One outlines the basic goals of engineering economic analysis. Chapter Two defines cost concepts such as life cycle cost, future cost, sunk cost, fixed cost, variable cost, and gives an introduction to cost estimation. The time value of money is discussed in Chapter Three, and the most important compounding factors are derived; both the discrete and the continuous versions are presented (with a tabulation of numerical values in the Appendix of the book).

The different methods of measuring investment worth (present worth, annual worth, internal rate of return, etc.) are developed in Chapter Four, and in the next chapter they are applied to the comparison of alternative investments. There is a good discussion of multiple solutions of the internal rate of return equation. Particular attention is given to the problem of comparing investments with different time horizons.

Inflation is treated rather briefly at the end of chapter Four. I would have liked to see more detailed statistics showing the history of inflation rates during the past decades together with the relation between typical rates of return and inflation. Also, the authors' recommendations for dealing with inflation do not alert the reader to the fact that tax effects of depreciation and interest deductions are different in constant and in inflating dollars (as shown, for instance, by Dickinson and Brown in their LBL report UCRL-52814 in 1979).

The effects of taxes are treated in Chapter Six. By examining the economic worth of the same investment under a variety of different financing schemes and depreciation schedules, the authors give a good illustration of the important role that taxes can play.

Chapter Seven provides an interesting discussion of public sector projects. Some instructive examples point out possible pitfalls of various accounting methods that are in use; in particular, the authors show how the cost benefit ratio can be drastically altered by different methods of counting costs.

Chapter Eight illustrates many methods for dealing with uncertainty. The authors give a good treatment of the case where a probability distribution can be assumed for the input variables; two approaches are developed: analytical solution, and numerical solution by computer simulation. Finally, Chapter Nine presents prescriptive models for decision-making under risk and uncertainty, for example the criteria of minimizing risk or maximizing gain, as well as varying intermediate degrees of optimism or pessimism. Decision trees are introduced for sequential decision making. Conditional probabilities are developed by means of an example, and they are applied to the interesting problem of estimating the value of obtaining additional information that can reduce the uncertainty of the decision.

The book contains a wealth of examples that convey a good sense of the wide variety of problems to be found in the real world. Valuable advice is given about the process of decision making and about the importance of nonmonetary considerations. The book also offers a large number of homework problems at the end of each chapter, with solutions available in a separate Instructor's Manual. The book is up-to-date. For example, Chapter Six gives a thorough discussion of the post 1981 tax law.

Of special interest to people in solar energy and other capital intensive technologies is the choice of the appropriate discount rate for an economic analysis. For instance in the solar industrial process heat program there has been some controversy about the fact that industry tends to use much higher discount rates than those popular among advocates of renewable energies. White, Agee and Case do not provide any specific data, far less any systematic survey of industrial discount rates or rates of return. But they do suggest 15 percent as a typical value for the minimum attractive rate of return (unfortunately without stating the corresponding inflation rate), and they emphasize it perhaps unintentionally by using this value in most of the examples.

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