interaction (as is emphasized throughout the book) among all the different factors leading to introduction of an alternative technology in any one case, such a framework is both difficult to develop and of questionable value.

Perhaps the most useful chapter in the book is the last one in which guidelines are suggested for facilitating the development of new technologies. For all actors involved (government, utilities, individuals, etc.), these include maintaining open information networks, discouraging monopolization, and minimizing biases, so that from an equal footing, the "best" technologies can be selected for development. Two principles are set forth concerning governmental action, which is singled out as particularly influential in the process of technological change: (1) Generally, the earlier the phase of development, and hence the greater the uncertainty in the value of a certain technology, the less government should be directly involved – winners should rise to the top, they should not be picked. In this phase, indirect government support, in the form of research and development funding, as an information supplier, and in general as a facilitator of an unconstrained development process, is still important; (2) The greater the role that a government will ultimately play in the production, distribution, and use of a given technology, the greater can be its involvement once some of the uncertainty surrounding the success of a given technology is lessened. Within the constraints of these principles, Baumgartner and Burns suggest a number of specific policy strategies for effecting transitions to alternative energy systems, ranging from manipulation of energy prices to encouraging (e.g., through incentives and subsidy programs) economically weak groups to invest in alternative energy technologies.

While many of these specific policy strategies and the general lessons drawn from the case studies could be applied to both new energy supply technologies and to new energy conserving technologies, the authors have focused on the former – how to replace troublesome supply sources (fossil fuels, nuclear power) with less troublesome ones (solar, wind, geothermal, wood, peat). However, it is often cheaper and less disruptive from a societal perspective to utilize alternative technologies that provide the same, or higher, levels of energy services (e.g., hot water, light), but which require significantly less energy than technologies in common use today. Given this fact, the focus on energy supply, rather than on the services energy provides, is one of the substantive shortcomings of a book that otherwise addresses important issues concerning the evolution of energy systems for the "post-petroleum" era in industralized societies.

The book is useful reading for energy policy analysts, members of social change movements, technological entrepreneurs, and others with an interest in effecting greater use of alternative, renewable energy technologies, but the language used is heavily sociological, reflecting the training of most of the contributors, so the substance may best be appreciated only by sociologists. This is unfortunate because, as is also one of the main theses of the book, communication between and interaction among many disciplines is essential for the successful introduction of alternative energy systems.

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Energy Engineering, by John W. Mitchell, Wiley-Interscience, New York 1983, 309 pages, price: $38.50.

The emphasis of this excellent book lies on the end use, rather than the supply of energy. Thus it is a good complement to texts on power generation such as *Engineering Evaluation of Energy Systems* by A. P. Fraas (McGraw-Hill, New York 1982), to name a fine example. Mitchell looks at energy use in buildings, in transportation, in industry, etc., with special attention to opportunities for energy conservation. He surveys all the relevant technologies, analyzes their performance, and evaluates their economics.

The Introduction sets the stage by showing how energy has been supplied and how it has been used in the past. Consumption patterns since 1950 for the United States are presented, disaggregated by end-use and by fuel type, and they are related to energy price changes (both in inflating and in real dollars). Projections for the future are suggested to emphasize the need for more efficient utilization of energy.

The second chapter shows how to calculate the life cycle cost of energy systems; it is well placed at the beginning of the book because it applies equally to all energy technologies.

Chapter Three analyzes the heating load of buildings. Mitchell presents not only the usual ASHRAE recipes for design day (i.e., peak) heating requirements, but he shows how to determine the annual consumption, based on the steady state model with variable base degree days. A formula is given for estimating the number of degree days relative to any balance point temperature.

Cooling is the subject of the next two chapters. The discussion includes such topics as the effect of clothing and of comfort conditions on cooling demand, and the relation between lighting and cooling loads. Mitchell also describes the different cooling systems of commercial buildings and shows why they can have a large effect on heating and cooling loads.

Chapter Six presents a clear analysis of furnace performance, both steady state and seasonal. Opportunities for improvements are highlighted, and recent developments are mentioned such as the highly efficient pulsed-combustion furnace. This is followed by a comprehensive chapter on heat pumps; it includes a simplified method for finding the seasonal average COP.

The discussion of power generation, Chapter Eight, is centered around the concept of availability. In keeping with the emphasis on conservation, Mitchell presents an interesting comparison of conventional power plants with cogeneration and district heating systems. Chapter Nine develops gas-fired heat pumps, also based on the availability concept.

The potential for energy savings in industry is illustrated in Chapter Ten with several important examples: the use of insulation, heat recovery, heat pumps, refrigeration, and recycling. The chapter on transportation shows how much power is required for ground friction, air friction, acceleration, etc., and how much could be saved by improved design. The discussion of the 55 mph speed limit in the United States is a good example how Mitchell looks at both costs and benefits. The book concludes with a chapter on renewable energy sources: biomass, wind, and solar.

Mitchell's book combines clarity and concision. He has shown good judgment in selecting the topics. The material is very up-to-date. Many examples are given, well integrated with the text. As always when presenting specific numbers for new technologies one is liable to be criticized for being either too optimistic or too pessimistic. I find that in general Mitchell's assumptions are very reasonable; also the analysis is so clearly developed that the reader can readily insert his own favorate numbers.

I find only few and minor points to criticize. The fact that

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.