

below current marginal or actual energy prices and alleviate an insidious decline in the supplies on which we now rely. (A "marginal energy price" incorporates the cost of a new supply, such as North Sea oil, rather than a cost averaged over existing supplies.) Such a claim demands that we pay careful attention not only to the costs of conservation, but also to conventional and unconventional resource bases. The SERI report omits conventional sources of energy but covers solar sources in detail. In very similar treatments Ross and Williams and Gibbons and Chandler devote chapters to reserves, costs, environmental impacts and other aspects of coal, gas and oil. They conclude that our current high levels of demand for precious fuels can only continue for another few decades and that impending depletion of conventional supplies will increase extraction costs. Both note the possibility that conventional gas may prove to be a vast and important resource.

Conservation. Energy conservation, the core of these books, has the potential to save a large share of our energy expenditures at costs below current fuel prices. All three books discuss how conservation potentials can be estimated, but the differences in emphasis are critical. Consider conservation in climate control. Gibbons and Chandler skip the heat-transfer aspects of energy conservation in buildings altogether and plunge directly into the matching of diminishing economic returns on investments in thermal integrity to the marginal cost of fuel supplies. Ross and Williams start from a slightly stronger technical base by discussing the well-known studies carried out at Twin Rivers by a Princeton group. They follow a microeconomic discussion similar to one of Gibbons and Chandler with a more detailed discussion of such policy matters as the desirability of creating a corps of "house doctors," dealing with the barrier of high initial costs, the poor targeting characteristics of specific (often tax) incentives and the virtues of an energy tax.

The SERI staff used the substantially greater space available to them to cover technical issues, economics and the likely impacts of incentives and other policies in far greater detail than could the other authors. Of special interest in the SERI presentation are "supply curves for conserved energy," which display relationships between national energy savings in a sector due to various technical measures and the marginal costs of saving fuel by the implementation of each measure. These curves offer a convenient way of comparing the relatively well-known costs of saving energy with the unknown and volatile future costs of fuel.

The report also covers transportation and industrial energy consumption in much more detail than the other two books.

Policy recommendations. All three books indicate their awareness of the political nature of energy problems by including substantial sections of policy recommendations. Some common threads are readily discerned: Inflexible, tightly targeted tax credits have been more trouble than they were worth; energy prices have not reflected the real marginal costs of energy; energy prices do not reflect externalities such as the damage attributable to a poor balance of payments or vulnerability to an embargo; in short, all the authors exhibit faith in the ability of markets to set things right if a few imperfections are corrected. There are two problems with this view. One is that nonmarket forces sometimes work more efficiently than free markets. The authors overlook nonmarket activities that could satisfy their inclinations: None of the current books suggests that the price of oil, clearly at nonmarket levels, should be lowered, even though that would both provide more accurate information and make peoples' lives easier. Pure market forces had little to do with the monopoly-controlled oil price rise and consequent interest in conservation. Rather, these were brought about by institutional and political forces.

The second problem with markets is that conservation involves the aggregation of many minute and detailed remedies. In most institutions, the amounts of money to be saved through conservation, even with six-month payback periods, are usually not large. An uncertainty principle operates in economics: Even in the presence of "perfect" market conditions, a rational decision will not be made if the money involved is too small to be worth the time required for management to think about it. It is doubtful that the freeing of enchain market forces will in itself be sufficient to ensure individual behavior that will ensure society's good.

Classroom use. Despite my carping, these are three very valuable books. Serious students of energy matters should consult the SERI study, although "reading" it would be akin to scrubbing floors with a toothbrush. Interested amateurs will read either Gibbons and Chandler or Ross and Williams with interest and probably not be seriously bothered by the omissions noted above. But how will these books serve in energy courses? Although none of them was written to be used as a text, the absence of other suitable material requires an evaluation. The best bets here are probably Ross and Williams and SERI (combined) for courses involving students

with the technical fortitude to face up to SERI's tables and Ross and Williams's appendices. Additional material on heat transfer, thermodynamics and the rudiments of engineering economics would also be required. Gibbons and Chandler's cleaner writing style, lower density and sporadic literary allusions will make their book a better choice for less technically oriented courses, but outside reading would be a necessary supplement even here. Although the all-around text may not have been written yet, either of these books could well serve as the focal point of an energy course.

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new books

History, Philosophy, Society & Government

Ludwig Boltzmann. Man-Physicist-Philosopher. E. Broda. 169 pp. Ox Bow, Woodbridge, Conn., \$22.50

James Clerk Maxwell: A Biography. I. Tolstoy. 184 pp. U. of Chicago P., Chicago, 1983. \$17.00 cloth, \$6.95 paper

Women Scientists in America: Struggles and Strategies to 1940. M. W. Rossiter. 439 pp. Johns Hopkins U.P., Baltimore, Md., 1982. \$27.50

A Search for Structure: Selected Essays on Science, Art, and History. C. S. Smith. 410 pp. MIT Press, Cambridge, Mass., 1983. \$15.00 paper

Risk/Benefit Analysis: The Microwave Case. N. H. Steneck, ed. 231 pp. San Francisco Press, San Francisco, 1983. \$15.00.

Grosse Physiker und ihre Probleme: Studien zur Geschichte der Physik. H. J. Treder. 284 pp. Akademie, Berlin, 1983. 68 DM

What About the Russians—and Nuclear War? Ground Zero. E. A. Molander, R. C. Molander. 236 pp. Simon & Schuster, New York, 1983. \$3.95

Space, Time and Mechanics: Basic Structures of Physical Theory. Papers, Colloquium, Munich, May 1979. D. Mayr, G. Sussmann, eds. 245 pp. Reidel (US dist. Kluwer, Boston, 1983). \$34.95

History of Modern Physics, 1800–1950. Project Y: The Los Alamos Story. D. Hawkins, E. C. Truslow, R. C. Smith. 506 pp. Tomash, Los Angeles, 1983. \$46.00

Scientific Temperaments: Three Lives in Contemporary Science. P. J. Hils. 302 pp. Simon and Schuster, New York, 1983. \$15.95

Echoes of the Ancient Skies: The Astronomy of Lost Civilizations. E. C. Krupp. 386 pp. Harper & Row, New York, 1983. \$19.95

La Gestion des Projets Spatiaux. Proceedings, Conference, May 1982. J. Muller, sec. 872 pp. Cepadues, Toulouse, France, 1982. 350 FF

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Energy and Environment

Variations of the Solar Constant. Proceedings of a Workshop, Goddard Space Flight Center, November 1980. S. Sofia, ed. 296 pp. NASA, Washington, D.C., 1981. *price not stated. compendium*

Energy for Developed and Developing Countries. Proceedings of the International Scientific Forum, Nice, France, October-November 1979. B. N. Kursunoglu, J. Couture, A. C. Millunzi, A. Perlmutter, L. Scott, eds. 190 pp. Health, Lexington, Mass., 1983. \$28.95

Handbook of Energy Audits. Second Edition. A. Thumann. 443 pp. Fairmont Press, Atlanta, Ga., 1983. \$36.00

Instrumentation and Techniques

Interface Technology for Computer-Controlled Manufacturing Processes. U. Rembold, K. Armbruster, W. Ulzmann. 362 pp. Dekker, New York, 1983. \$48.50

Thermal Analysis and Control of Electronic Equipment. A. D. Kraus, A. Bar-Cohen. 620 pp. McGraw-Hill, New York, 1983. \$49.95. *text*

Large Scale Integrated Circuits Technology: State of the Art and Prospects. Proceedings of the NATO Advanced Study Institute, Erice, Italy, July 1981. L. Esaki, G. Soncini. 746 pp. Nijhoff, Boston, 1982. \$99.00

Remote Sensing: Optical and Laser. D. K. Killinger, A. Mooradian, eds. 383 pp. Springer-Verlag, New York, 1983. \$34.00. *compendium*

Vacuum Technology, Thin Films, and Sputtering: An Introduction. R. V. Stuart. 151 pp. Academic, New York, 1983. \$21.00. *text*

Structured Digital Design Including MSI/LSI Components and Microprocessors. R. M. Kline. 450 pp. Prentice-Hall, Englewood Cliffs, N. J., 1983. \$28.95. *text and reference*

Design of Crystal and Other Harmonic Oscillators. B. Parzen. 454 pp. Wiley, New York, 1983. \$44.95. *reference*

Theory and Mathematical Physics

Foundations of Quantum Mechanics. I. G. Ludwig. 426 pp. Springer-Verlag, New York, 1983. \$48.00. *graduate text*

Molecular Collision Dynamics. J. M. Bowman, ed. 158 pp. Springer-Verlag, New York, 1983. \$19.00. *four monographs*

Information, Uncertainty, Complexity. J. F. Traub, G. W. Wasikowski, H. Wozniakowski. 176 pp. Addison-Wesley, Reading, Mass., 1983. \$34.95

The Physics of Vibration. Vol. 2. The Simple Vibrator in Quantum Mechanics. A. B. Pippard. 208 pp. Cambridge U.P., New York, 1983. \$39.50. *reference*

Quantum Structure of Space and Time. Proceedings, Nuffield Workshop, Imperial College, London, August 1981. M. J. Duff, C. J. Isham, eds. 432 pp. Cambridge U.P., New York, 1983. \$49.50

The High-Energy Limit. Proceedings, Eighteenth Course of International School of Subnuclear Physics, Erice, Italy, August 1980. A. Zichichi, eds. 1104 pp. Plenum, New York, 1983. \$125.00

A Gauge Theory of Dislocations and Disclinations. A. Kadic, D. G. B. Edelen. 290 pp. Springer-Verlag, New York, 1983. \$12.50. *monograph*

Quantum Theory of Magnetism. Second Edition. R. M. White. 282 pp. Springer-Verlag, New York, 1983. \$30.00. *text*

Molecular Collision Dynamics. J. M. Bowman, ed. 158 pp. Springer-Verlag, New York, 1983. \$19.00. *compendium*

Differential Geometry and Mathematical Physics. Lectures, Meetings of the Belgian Contact Group on Differential Geometry, Liege, May 1980 and Leuven, February 1981. M. Cahen, M. De Wilde, L. Lemaire, L. Vanhecke, eds. 188 pp. Reidel (US dist. Kluwer, Boston, 1983). \$28.50

Gauge Theory and Gravitation. Proceedings, International Symposium, Nara, Japan, August 1982. K. Kikkawa, N. Nakaniishi, H. Nariai, eds. 316 pp. Springer-Verlag, New York, 1983. \$18.00

Geometric Quantization in Action: Applications of Harmonic Analysis in Quantum Statistical Mechanics and Quantum Field Theory. N. E. Hart. 336 pp. Reidel (US dist. Kluwer, Boston, 1983). \$49.50

Theory of Phase Transitions: Rigorous Results. Y. G. Sinai. 153 pp. Pergamon, New York, 1983. \$27.00. *graduate text*

Random Fields: Analysis and Synthesis. E. Vanmarcke. 382 pp. MIT Press, Cambridge, Mass., 1983. \$45.00

A Symmetry Primer for Scientists. J. Rosen. 192 pp. Wiley, New York, 1983. \$26.95

Bypasses: A Simple Approach to Complexity. A. A. Melzak. 245 pp. Wiley, New York, 1983. \$34.95. *monograph*

ETO Multicenter Molecule Integrals. Proceedings, First International Conference, Tallahassee, Fla., August 1981. C. A. Weatherford, H. W. Jones, eds. 186 pp. Reidel (US dist. Kluwer, Boston, 1983). \$37.00

Materials Science and Condensed Matter

Encyclopedia of Physics. Vol. 31. Coruscules and Radiation in Matter. I. W. Mehlhorn, ed. 630 pp. Springer-Verlag, New York, 1982. \$131.20 cloth, \$105.00 paper

Alignment of Nematic Liquid Crystals and Their Mixtures. Supplement 1 of Molecular Crystals and Liquid Crystals. J. Cognard. 77 pp. Gordon and Breach, New York, 1982. \$27.00

Materials Analysis by Ion Channeling: Submicron Crystallography. L. C. Feldman, J. W. Mayer, S. T. Picraux. 300 pp. Academic, New York, 1982. \$42.00. *second-level text*

Soviet Scientific Reviews, Sec. A. Physics Reviews. Vol. 4 (1982). I. M. Khalatnikov, ed. 286 pp. Harwood, New York, 1982. \$113.50

Extended Linear Chain Compounds. J. S.

Miller, ed. 561 pp. Plenum, New York, 1983. \$55.00. *compendium*

Solid Hydrogen: Theory of the Properties of Solid H₂, HD, and D₂. J. Van Kranendonk. 306 pp. Plenum, New York, 1983. \$39.50

Excited States. Vol. 5. E. C. Lim, ed. 204 pp. Academic, New York, 1982. \$49.50. *compendium*

Preparation and Properties of Thin Films. K. N. Tu, R. Rosenberg, eds. Academic, New York, 1982. \$48.00. *compendium*

Points, Lines and Walls in Liquid Crystals, Magnetic Systems and Various Ordered Media. M. Kléman. 322 pp. Wiley, New York, 1982. \$59.95. *reference*

The Structure and Properties of Solids: An Introduction to Materials Science. B. Chalmers. 155 pp. Heyden, Philadelphia, 1982. \$21.95

Metal Vapours in Flames. C. T. J. Alkemade, T. Hollander, W. Snelleman, P. J. T. Zeegers. 1033 pp. Pergamon, New York, 1983. \$95.00. *reference*

Atomistics of Fracture. Proceedings, NATO Advanced Study Institute, May 1981, Corsica. R. M. Latanision, J. R. Pickens, eds. 1074 pp. Plenum, New York, 1983. \$115.00

Crystallography in North America. D. McLachlan, J. P. Glusker, eds. 479 pp. American Crystallographic Association (dist. Polycrystal Book Service, Western Spring, Ill., 1983) \$50.00. *compendium*

Thermal Conductivity 16. Proceedings, Sixteenth International Conference, November 1979, Chicago. D. C. Larsen. 623 pp. Plenum, New York, 1983. \$79.50

Miscellaneous

An Inventory of Published Letters to and from Physicists, 1900-1950. B. R. Wheaton, J. L. Heilbron, eds. University of California, Berkeley, 1982. \$20.00

Solar System Physics & Chemistry & Papers for the Public. Vols. 5 and 6 of Collected Papers of W. F. Libby. L. M. Libby, ed. Geo. Science Analytical, Santa Monica, Cal., 1981. *no price stated*

McGraw-Hill Encyclopedia of Physics. S. P. Parker, ed. 1343 pp. McGraw-Hill, New York, 1983. \$54.50

Masters Theses in the Pure and Applied Sciences. Vol. 26. W. H. Shafer, ed. 321 pp. Plenum, New York, 1983. \$75.00

More Science Braintwisters and Paradoxes. C. P. Jargocki. 142 pp. Van Nostrand Reinhold, New York, 1983. \$14.95

The Cosmic Dancers: Exploring the Physics of Science Fiction. A. Goswami, M. Goswami. 292 pp. Harper & Row, New York, 1983. \$18.50

The Individual's Guide to Grants. J. B. Margolin. 295 pp. Plenum, New York, 1983. \$15.95

The Roving Mind. I. Asimov. 350 pp. Prometheus, New York, 1983. \$17.95. *essays*

Handbooks and Tables in Science and Technology. Second Edition. R. H. Powell, ed. 297 pp. Oryx, Phoenix, Ariz., 1983. \$55.00. *bibliography* □