BOOK REVIEWS

Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.

The Structure of World Energy Demand

Author Robert S. Pindyck

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Reviewer Helmut J. Frank

Engineers, scientists, and policy makers (let alone the general public) have been thoroughly confused as to certain key facts essential to formulating sound national energy policy. In particular, they have lacked reliable information needed to decide whether energy shortages should be alleviated by mandatory controls, including rationing, or whether market forces, i.e., the price mechanism, can or should be relied on to do the job. The issue subdivides further into questions of efficiency versus equity, with various parties assigning quite different weights to these two objectives. Pindyck concentrates on the former issue, i.e., the ability of prices to effect the adjustment process, leaving matters of fairness aside (presumably to be considered in the context of taxation and welfare programs).

The study was supported by a grant from the RANN Division of the National Science Foundation and the Center for Energy Policy Research of the Massachusetts Institute of Technology (MIT) Energy Laboratory, and forms part of a larger project at MIT to develop analytical models of the world oil market. It summarizes the results of econometric studies of world energy demand, principally in the residential and industrial sectors for selected industrialized countries, although some work was also included on transportation and a few developing nations. Among the important questions the author examines are: To what extent does energy demand respond to changes in energy prices in the long run, when users have time to change the stock of capital (buildings, cars, appliances, etc.)? Is the "structure of production" (i.e., the relationship of energy to capital and labor) complementary or substitutive? What are the possibilities of interfuel substitution when relative fuel prices change significantly? What is the impact of major changes in energy prices on macroeconomic output? How do the characteristics of energy demand in the industrialized countries differ from those of the less developed countries?

Pindyck provides few definitive answers to these questions; no one else could either at this point in the development of the state-of-the-art. But he does shed a great deal of light on several issues by analyzing the structure and assumptions of models developed by other investigators, comparing them with his own, and stressing the usefulness and limitations of various methodologies. These sections alone, coupled with the extensive, up-to-date bibliography, which includes 166 entries, make acquisition of the volume by students of energy worthwhile. The author's most important contribution to the literature, however, consists in his use of models of the most generalized type—indirect translog utility functions for demand and translog cost functions for production—to test structural relationships in the residential and industrial sectors, respectively. These functions are free of the *a priori* restrictions imposed by most other approaches, and permit various hypotheses concerning demand characteristics to be tested empirically, rather than assumed in advance. Moreover, Pindyck uses pooled time series and cross-sectional data, whenever possible, which yield unbiased long-run results rather than mere short-term answers limited to a single country.

The results are often strikingly different from those obtained previously, results on which national energy policy makers unfortunately have heavily relied to date. For example, he finds the long-run energy price elasticity in the residential sector to be about −1.1, implying that for, say, a 10% increase in energy prices, consumption will fall by 11%. This compares with the general impression of a range of −0.2 to −0.3. Similarly, his energy price elasticity in the industrial sector, −0.8, is substantially higher than previously thought. He finds evidence that energy and capital may be substitutes in the long run in many industries, rather than complements, as generally believed thus far. The policy implications are important, since this would mean that industrial users are not limited to substituting labor for capital/energy when energy prices rise sharply. Cross-price elasticities for individual energy sources also are found quite high, with the major exception of electricity. The transportation model, which is limited to automobiles, also yields quite high elasticities, though only with time lags sufficient to permit full replacement of vehicle stocks (8 to 14 years).

The study's full exposition is designed primarily for practitioners of the art of energy demand modeling. Others, including policy makers and students of energy problems, generally can omit the more technical portions and concentrate on the summary and comparison sections, which are concise but quite readable.

Helmut J. Frank (PhD, Columbia University, 1961) is professor of economics and director of the Division of Economic and Business Research at the University of Arizona. His interests in energy date from 1950, when he joined the staff of W.J. Levy Consultants in New York City, a firm specializing in the analysis of energy problems. He has also been affiliated, as consultant or research associate, with such organizations as Resources for the Future, the Electric Power Research Institute, the Petroleum Industry Research Foundation, and the Gas Requirements Agency at the University of Denver. In 1975 and 1976, he was a member of the Citizens Energy Task Force of Arizona. He has authored and co-authored numerous publications.

Advances in Nuclear Science and Technology

Editor	Ernest J. Henley, Jeffrey Lewins, and Martin Becker
Publisher	Plenum Press (1979)
Pages	565
Price	$45.00
Reviewer	Clarence E. Lee

Eight topics covering a wide range of developments are reviewed in this eleventh volume of *Advances in Nuclear Science and Technology*, edited by Ernest J. Henley, Jeffrey Lewins, and Martin Becker. The topics are organized into three basic categories–science, technology, and the practicalities of nuclear power.

J. Walker and D. R. Weaver of the University of Birmingham review basic "Nuclear Physics Data for Reactor Kinetics," discussing the information available in five evaluated libraries (ENDF/B-IV, ENDL, UKNDL, KEDAK3, and SOKRATOR) as well as fission product, delayed neutron, and heavy element data. Various evaluations of absolute and relative group yields are compared. Recent experiments on delayed neutron spectra from thorium, uranium, and plutonium and the neutron spectra from single precursors are summarized. The major fuel nuclides and transactinium nuclides are reviewed with respect to accuracy, improvement requests, and calculational discrepancies due to group structure, data files, and coarse spatial representations in reactor calculations.

N. Pacilio, A. Colombio, R. Mosiello, F. Norelli, and V. M. Jorio, Comitato Nazionale per l'Energia Nucleare, review the stochastic theory form of reactor kinetic theory in "Analysis of Reactor Noise." A unified analytical theory for reactor noise is developed using the time-dependent differential equation in the state-generating function. Transforming this equation into a set of differential equations in the factorial moments or factorial cumulants of the state variable admits analytic solutions, especially in situations in which integrations of the generating function equation have been difficult or impossible. Numerous models are examined and explained in detail and the solutions (including limits) are developed under the ergodic hypothesis. A valuable compilation of over 20 experimental methods, observed probabilities, and formulas for data interpretation are included, and as well, a summary of the correspondence between the stochastic parameters and kinetic parameters is elucidated.

M. W. Jervis, Central Electricity Generating Board (CEGB), gives an update review of "On-line Computers in Nuclear Power Plants," as developed in both the U.K. and Canada. On-line computers supply a unique capability in power plant operation as part of the total control and instrumentation system. Policy formation basis, problem areas, and solution techniques are critically reviewed with reference to CEGB nuclear power plants. Computer functions and application classes are summarized and explained in considerable detail. Computer hardware and software systems and examples in the U.K. and Canadian operating plants are discussed. Cathode ray tube (CRT) displays in control room design and ergonomic factors are reviewed. Important aspects of reliability, obsolescence, replaceability, project management, and program and data security, as well as initial design licensing, modifications during the life of the plant, and the impact of future developments, are addressed. Considerable progress has occurred in CRT and alarm analysis. Continued investigation and improvement in operations research and reliability targets are recommended to establish the analysis-selection processes of significant and organized information through relatively few available channels for a more optimal operator response.

D. O. Pickman, J. H. Gittus, and K. M. Rose, United Kingdom Atomic Energy Agency, review the design of "Fuel for the SGHWR" (Steam Generating Heavy Water Reactor). Fuel design integrity criteria for the 36- and 60-rod distributions are examined. Operating experience on burnup, coolant flow and steam quality, fretting, dimensional changes, fuel/cladding gap, fission gas release, UO_2 swelling, corrosion and deposition, irradiated cladding mechanical properties, power cycling and ramps, and fuel defects is discussed. If logical design bases and performance predictions are to be maintained, then the development of performance model computer codes is imperative. The SEER-SLEUTH computer code modeling and validation of cladding and cladding fuel interaction are reviewed. Accident analysis of stagnation loss-of-coolant accidents (LOCAs), cladding diameter increase simulation using the Programmed Pressure and Temperature Fuel Rod testing rig, fuel behavior during irradiation, and measured pressure tube tests using the Bluster Blowdown rig are discussed. The transient modeling capabilities of the CANSWEL-1 and CANSWEL-2 (under development) computer codes are outlined and the reasonable comparisons obtained with test data relevant to LOCA and with simulated pressurized water reactor transients are reviewed. Future work on fuel cladding corrosion and incidence of defects is outlined.

M. Ishikawa and T. Inabe, Japan Atomic Energy Research Institute, describe the program of "The Nuclear Safety Research Reactor (NSRR) in Japan" related to reactivity-initiated accidents (RIA) of light water reactors (LWRs) and fast breeder reactors. The NSRR driver core is a TRIGA-Annular Core-Pulsed Reactor that generates very