# Model solutions to energy forecasting

M.R. Alexander

**Energy Strategies for the UK.**
By S.C. Littlechild and K.G. Vaidya.
*George Allen & Unwin: 1982. Pp.232. £15, $29.95.*

"THOSE who foretell the future lie even when they tell the truth" — in the light of this truism from the Koran, what credibility can forecasters hope to achieve? *Energy Strategies for the UK* describes the mechanism formulated by its authors to look into the future — the Birmingham Energy Model (BEM), a linear-programme-based optimization model — using "current" estimates of future costs, details of environmental constraints in the United Kingdom and views on fuel prices.

The BEM constitutes a laudable attempt on the problem of energy forecasting, but perhaps so difficult a task is best not dealt with by so rigorous an approach. Optimization must be directionally correct but we know so little of the future that any optimum is likely to be highly erroneous and debatable. In addition, the 1982 world energy scene looks so different from its 1977 counter-part which provides the basis of the book.

Besides the numerous uncertainties which the authors analyse in Chapters 6 and 7 (including levels of oil and gas reserves, different oil and gas price profiles, variations in the terminal value of fuel reserves, discount rates, security of the UK's oil supply, and fluctuations in the UK's balance of payments and level of coal imports) the model has to assume a detailed knowledge of other aspects of the future. One further area of uncertainty must be technology; another the interrelationship, on an international scale, between fuel discovery rates, relative prices and inter-fuel substitution; and a third political direction.

As to technology, a primary consideration is the potential of synthetic oil and gas. That potential depends upon production costs. In 1982 the IEA stated in their paper *Coal Liquefaction — A Technology Review* that

> the product cost from a full scale coal liquefaction plant is likely to be between US $60 and US $100 per barrel in 1982 prices. Since *no* full-scale direct coal liquefaction plant (the major single cost component) has been built, even the most careful estimates have some uncertainty. A full detailed engineering, design and costing study for a specific coal, process and site would cost of the order of US $100–200 million.

If this was the state of affairs last year, what faith can we place in results generated from 1977 estimates; or in 1990 on the 1982 forecasts? And can we believe the authors' assertion (p.134) that an optimal solution involves using coal to make synthetic oil whilst simultaneously oil is used in the production of peak-saving electricity?

Fuel prices, the basic model determinant, hide enormous utilization differences. Real energy price comparisons are difficult to make, as they include both the energy and the "quality" components (e.g. calorific content and the storage, handling and exhaust gas scrubbing costs of coal). Many American companies (General Motors, for instance) have found the technical advances in the use of electricity overcome its apparent regional (3:1) price disadvantage to natural gas. Typical preferred electricity uses now include paint and ink applications, electric induction furnaces to melt metals, microwave dryers and lasers for metal treatment.

Politics complicate matters even further; some current imponderables include the effects of EEC acid rain regulations, US pressure to reduce Russian gas exports and, more parochially, the retention of uneconomic coal mines and industrial restructuring.

In *Energy Strategies for the UK* the authors illustrate through their model a range of energy options, and the book will provide a useful basis for student discussion. However, although the authors rightly provide a variety of solutions, they give little guidance towards identifying the "most desirable". With oil production results gyrating up to 100%, as seen in Chapter 6, readers would have profited from some probability analysis of the input parameters and the identification of the median or recommended result. □

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# Stress on crystals

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**Comparative Crystal Chemistry: Temperature, Pressure, Composition and the Variation of Crystal Structure.**
By Robert M. Hazen and Larry W. Finger.
*Wiley: 1983. Pp.231. $43.95, £19.50.*

THIS is a gem of a book! It is divided into two parts of approximately equal length, the first of which covers the technical problems of studying crystal structure at high pressure.

The discussions here are complete, thorough and clear, those on the various types of diamond anvil cells currently in use being especially well done. One can get a real feel for the techniques, methods of construction and problems in using the cells, as well as for the applications of various designs. Every aspect of the topic is included except a set of dimensioned engineering drawings, and this lack is partially compensated for by a list of vendors. The account of how to add the variable of high temperature is equally complete. In each case the authors clearly outline the advantages, limitations and possibilities.

In the final chapter of this section one is given a reasonably detailed treatment of how to extract information from the X-ray measurements, together with a program for calculation of strain tensor from unit cell measurements. It is not intended that one could learn X-ray crystallography from scratch from the book but the discussion is most helpful.

The second half of the book deals with structures and lattice parameters as affected by temperature, pressure and composition. The emphasis is overwhelmingly on ionic model compounds, especially oxides, and on the more complex silicates found in the Earth. Within this rather restrictive limitation, however, the results presented are remarkably complete. A wide variety of largely empirical relationships involving lattice parameters and elastic or thermodynamic functions are presented, and there would appear to be here a rich source of information for the theorist.

*Comparative Crystal Chemistry* will be a "must" for both geochemists and geophysicists. It is written so that either an experienced practitioner or a student can use it. In addition, much of the material should be helpful to solid state chemists as well as some solid state physicists. □

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# Useful neurohormones

Larry L. Keeley

**Insect Neurohormones.**
By Marie Raabe.
*Plenum: 1982. Pp.352. $42.50, £29.75.*

MARIE Raabe has undertaken the heroic task of trying single-handedly to bring order to a large body of information that has not previously been comprehensively reviewed. During the past 20 years, most research reports, books, review articles and symposium proceedings dealing with insect endocrinology have focused on the ecdysones and juvenile hormones, with only cursory attention being given to the neurohormones and their regulatory effects. As the author makes clear, however, neurohormones exert profound effects on a wide variety of physiological processes in insects. The recent upsurge of work on vertebrate neuroendocrinology and neurobiology has led in addition to a growing interest in insect neuroendocrin-