showing that he had looked at more than, say, three or four paragraphs of the text; and had he then criticized it in terms that rose above mere spleen, I would have taken it as at least allowable comment. I have reviewed in this journal, on occasion quite critically, and have had no indication that the authors so treated felt they had been subjected to anything other than reasonable criticism. When something of mine is in the dock I expect the same treatment.

With your leave I will take up the one point in Banks' piece that had any intellectual substance. He criticizes my comments on the steam coal spot market and its popular attachment to either Rotterdam or Antwerp. I am aware that a 'spot market' denotes 'a way of doing business' (to be precise, it is defined by what is traded – present not future supplies or contracts). I am also aware that, in the age of telephone and telex, attributing such markets to particular locations must always be qualified. Even a modestly perceptive reader, looking at the whole of my account, would see that it is concerned (i) to appraise the *continuity* of the steam coal spot market in Western Europe, and (ii) to assess just what significance does attach to labels like 'Rotterdam' or 'Antwerp' (and I did use inverted commas).

In the latter connection physical availabilities are *not* irrelevant, since there is frequently a basis of this kind, however historical or attenuated, drawing a spot market to a specific place. Even in the Rotterdam oil market, which I noted as not being physically confined to that city, and despite the importance of cargo trading, also noted, it has been tentatively estimated that one half to two-thirds of the oil traded in the late 1970s passed *physically* through ARA. Turning to steam coal, there is currently an active spot trading sitution in the Pacific, unattached to any particular centre and conducted under a different trading structure from that of NW Europe. But that market is a product of current oversupply conditions in energy markets, and its ability to survive the passing of these conditions must be questioned. In short the relation between physical availabilities in particular locations and the existence of a *continuous* spot market in steam coal is not a simple matter, and in Europe is subject to ongoing developments. My discussion was framed to dispel one variety of misunderstanding of the matter.

On the cost effectiveness of my work, which Banks questions, I leave this to the reader who can easily judge what was necessary to do justice to the remit of the report.

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[1]*Energy Policy*, Vol 11, No 1, March 1983, p 88.

Book reviews

Mining the literature – coal makes a comeback?

COAL UTILISATION: Technology, economics and policy

by L. Grainger and J. Gibson

Graham and Trotman, London, 1981, 526 pp, £18.00

THE FUTURE OF COAL

by Peter James

Macmillan, London, 1982, 296 pp, £20.00

STEAM COAL IN SOUTHERN AFRICA

by R.B. Olliver

The Economist Intelligence Unit, London, 1982, 94 pp, £120

COAL MODELS AND THEIR USE IN GOVERNMENT PLANNING

edited by James Quirk, Katsuaki Terasawa and David Whipple

Praeger, New York, 1982, 288 pp

Like the mining industry itself, the coal literature is well established, widely distributed but somewhat long in the tooth. Thus, it is a matter of some surprise to new entrants to the energy policy field that, compared with the voluminous material available on the oil and gas industries and until fairly recently, there has been relatively little on coal-related issues. Nevertheless, the reawakening of policy interest in coal over the last decade has stimulated authors and publishers to remedy this deficiency.

The four books reviewed here typify the heterogeneous character of the recent literature on coal. That by Grainger and Gibson focuses primarily on the technology of coal utilization and conversion. The authors are amongst the most informed and qualified commentators on the industry – notwithstanding their many earlier posts, they were both (successively) Members for Science of the National Coal Board (NCB). Without doubt, their book is destined to become a classic. The early sections review the history, chemical and physical properties, resource base and methods of winning coal. The prime emphasis is placed on the technology (250 pages) and the economics (100 pages) of coal utilization including direct combustion, carbonization, gasification (both surface and underground), liquefaction and coal as a chemical feedstock. Each chapter in this section reviews the principles of, and progress with, each technology and the coverage includes the programmes in the UK, FR Germany and USA in some detail, with briefer insights into efforts underway

elsewhere (eg South Africa, Japan, the USSR and Australia). The book concludes with an assessment of coal's role in smoothing the transition away from dependence on oil and gas and an invaluable, well researched bibliography.

Inevitably, the coverage is somewhat uneven, and an assessment of the book's strengths and weaknesses depends upon subjective criteria. Bearing this caveat in mind, the chapters on coal gasification technology and the coalplex concept are arguably the most valuable and lucid in the literature; the treatment of environmental impacts is more technical than economic; and conservation is accorded the grand total of two paragraphs. Most disappointing of all is the treatment of direct industrial-scale combustion, especially the economic analysis of atmospheric fluidized bed combustion and coal/oil mixtures and the use, for the purpose of illustrating the economics of oil to coal substitution, of a 150 000 lb/hr shell boiler – twice the size of any shell boiler and four times that of any coal-fired shell unit currently available in the UK (pp 332–333). Despite these criticisms, the book is a major addition to the literature and it is to be hoped that a revised and updated second edition (perhaps in paperback to widen its market) will remedy these deficiencies.

In *The Future of Coal,* James attempts to provide what is described as 'the first comprehensive account of the world coal industry'. Undertaking such a task within the confines of 270 pages is analogous to painting a large canvas with a broad brush. It is perhaps inevitable, therefore, that whilst the text is lucid and the book well structured to serve its defined purpose, the content is more descriptive than analytical in content.

Environmental impacts

An initial overview of coal formation, geology and classification is followed by a brief assessment of coal use, technology and major markets. James then provides a most useful summary of the main environmental impacts of coal, noting in passing that as early as 1257 Queen Eleanor is reported to have left Nottingham as a result of smoke from coal burning.

However, the major emphasis of the book (and its real value – at least for the general reader) lies in the author's broad analysis of global coal production, consumption and trade. Here, the USA, USSR and Western Europe are accorded the lion's share of the text, but there are also briefer snapshots of each of the Comecon countries, Australia, New Zealand, South Africa, Canada and Japan, and of the major producers in Africa, Asia and Latin America. The book concludes with an overbrief discussion of the future of coal to 2000, based heavily on the findings of the World Coal Report (WOCOL).

Assessment

For each of the major countries, James provides a field-by-field assessment of reserves and production and useful information (culled from a wide range of sources) on the organization of their coal industries, their environmental and other regulatory frameworks, indigenous markets and export prospects.

Given the surprising neglect of the fossil fuel potential of the non-Communist developing countries in much recent literature, it is refreshing that James places some emphasis on their coal-related activities, though there is heavy reliance on earlier work by WOCOL and the World Bank and, in some cases, these countries' profiles are presented only at paragraph length.

His assessment of the future of coal to 2000 can best be described as concise, covering only 14 pages. It is particularly disappointing that his discussion of coal prices – surely of more central concern to most policy makers than questions regarding physical availability – is so cursory and based largely on the views of other commentators. True, the recession-induced weakening of the oil market and the consequent loss of faith in the old shorthand consensus ('oil prices will double in real terms to 2000' etc) makes exercises in crystal ball gazing even more hazardous than once they seemed. But it would have been useful had the author subjected WOCOL's analysis to more rigorous examination. Nevertheless, the book provides a useful distillation of global coal developments – aimed perhaps at the general reader rather than the specialist. One particular, perhaps minor, feature of the book needs highlighting: for reasons best known to the author or publisher an output range which is conventionally printed as 127–138m tonnes becomes 127–38m tonnes in this book (eg p 189). As, on first confrontation this notation caused difficulties even for the reviewer, the general reader should be forewarned.

In 1900, South Africa was producing less than 1 million tonnes of coal per year. Output reached 17 million tonnes in 1940, 53 million tonnes in 1970 and some 115 million tonnes in 1980. More spectacularly, exports rose from under 3 million tonnes in 1975 to nearly 30 million tonnes in 1980. Given this considerable recent expansion, and much evidence to support continued growth, Olliver's study of *Steam Coal in Southern Africa* is particularly timely. Whilst short profiles are provided on Zimbabwe and Botswana, the main focus is upon the Republic of South Africa.

Resource estimation

The first comprehensive analysis of South Africa's coal resources was undertaken by the Petrick Commission of Inquiry between 1970 and 1975. The Inquiry reported that total resources had been estimated at 81 billion tonnes – of which 25 billion was regarded as economically recoverable bituminous coal capable of extraction via underground mining. Given that many of the Commission's techno-economic resource assessments were based on pre-1974 oil prices and that further exploration has been undertaken, it is not surprising that its estimates have been subject to steady upwards revision. By 1981, the government announced that coal resources had been re-assessed at 110 billion tonnes and underground recoverable reserves at 51 billion tonnes. In addition, the Petrick Commission, using conservative 'stripping' (overburden to coal) ratios, considered that an additional 7

billion tonnes of economically recoverable coal could be recovered using open-cast techniques.

Since 1974 (for 'strategic' reasons) the South African government has withheld detailed oil statistics, making overall energy demand and supply balance assessments difficult. However, Olliver estimates that in 1981 coal met 80% of total energy requirements and that two-thirds of domestic coal consumption was used for electricity generation (predominantly by the public utility, Escom). The second largest domestic market was for coal to oil conversion in the Sasol plants. By 1985, the three Sasol plants are expected to consume 33 million tonnes of coal annually and to meet almost half of petrol/diesel demand.

In May 1981 the government estimated total coal output as likely to be 330 million tonnes in 2000, of which domestic demand was put at 250 million tonnes (160 million tonnes for Escom alone), leaving an export surplus of some 80 million tonnes. Amongst many other important variables – even in such a 'trends continued' calculation – are the likely evolution of wage costs in this labour-intensive industry, prospects for increased investment and mechanization, government policy towards exports, transport infrastructure provision, etc. Politics apart, these hold the key to future levels of coal output and exports. Whilst Olliver is, perhaps, insufficiently critical of official projections (especially of coal and electricity output), his study provides an invaluable assessment of coal developments in Southern Africa.

Contribution of models

The book edited by Quirk *et al* comprises a collection of 15 updated papers originally presented to a conference organized in 1979 by the Jet Propulsion Laboratory (JPL) and the US Department of Energy. The overall objective was to analyse the contribution long-term US forecasting models could make to federal energy planning with particular emphasis on coal supply. In addition, the JPL was seeking detailed market assessments to support its role in developing an advanced underground coal extraction system (an amazing example of diversification if ever there was one).

Space constraints preclude an adequate assessment of this disparate collection of papers. Whilst four deal with various aspects of coal supply and demand modelling, others cover the leasing of federal coal lands, the market penetration of nuclear power, a 'Kantian perspective on the social rate of discount', intergenerational equity and resource depletion, investment 'for municipal infrastructure in energy-impacted communities' and a highly simplistic model of R&D expenditures.

The paper by Burness on future additions to supply capacity notes the decline in availability of large conventional steam generating plant over the period 1947–77. Whilst his analysis is far from being complete, the conclusions are of sufficient general interest to warrant highlighting. He argues that engineering considerations should receive greater weight than the search for (elusive) scale economies and that additional capacity requirements are 'best met through the addition of larger numbers of smaller, more reliable, plant' (p 236).

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Prospects for coal

STEAM COAL AND ENERGY NEEDS IN WESTERN EUROPE BEYOND 1985

by Michael Prior

EIU Special Report No 134, Economist Intelligence Unit, London, 1982, 70 pp, £75

CONSTRAINTS ON INTERNATIONAL TRADE IN COAL

by Ray Long

IEA Coal Research, London, 1982, 136 pp, £50, $90

The economics of the international coal trade are still pretty clouded. The major studies can be counted on the fingers of one hand, and, though their estimates of future production are relatively consistent, estimates of final demand and trade flows are still highly fluid – though increasingly pessimistic. These two studies are both useful contributions to the debate.

Prior's report is an extension of previous work by the Economist Intelligence Unit which has, up to now, taken the European coal scene up to 1985. Prior has extended this analysis to 1990. The chief virtue of his approach is that he refuses to rely on official projections and has instead constructed a 'bottom-up' picture of the European scene by looking at each country's actual and likely performance in converting existing electricity generating and industrial plant to coal firing. His projections are thus fairly firmly based on actual decisions, rather than on vague aspirations.

Pessimism

His conclusions come to yet another downgrading of coal demand and import figures for 1990. He suggests that Western Europe will consume 320 million tons (coal equivalent) in 1990, compared with the 358 million forecasted by the IEA's 1978 steam coal study, or WOCOL's estimate of 416 million. His relative pessimism obviously owes something to more cautious estimates of likely economic growth during the 1980s, but also to a growing scepticism about the speed of industrial conversion to coal, and a growing disbelief that coal liquefaction or gasification are likely to make more than a minimal contribution to coal demand over the next 10 or 15 years. In fact, he sees a relative stagnation of European coal demand in the 1990s, which may not be broken until coal gasification emerges around the year 2000 (if then).

He has interesting things to say about the European port scene, and on the likely European positions on the