

## INTRODUCTION

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The British Institute of Energy Economics (BIEE) has a broadly educational remit and in recent years this has included the sponsoring of inexpensive and mainly academic conferences on current issues in energy economics and policy. This has proved an excellent way of bringing a quite disparate academic community together, and adding to it a large number of interested industry and Government people to discuss contemporary issues (see Andrew Barton's foreword to this volume). Imperial College Press published the whole proceedings of the first such conference,<sup>1</sup> amounting to 36 papers. This was the first such academic volume to emerge from the UK for some years.

The second BIEE conference was held at Warwick in December 1997, and attracted even more papers - more than 50 in all. This time the focus was on a wider international experience, but still based to a degree on an assessment of the UK model of change in the energy sector: in what ways, and how well had this model (or set of models) travelled elsewhere in Europe and to the rest of the world?

In approaching the issue of publication, it was impractical to try and publish more than 50 papers from the conference. Instead we decided to select around half of the best papers, partly influenced by what we believed were the main intellectual and pragmatic themes that emerged at the conference. What we present here is therefore not a conference proceedings but rather a selection of readings on a range of distinct topics.

Because this book was not to be simply a proceedings volume, we also decided to allow authors a reasonable time in which to consider making changes or improvements to the versions submitted to the conference itself. All authors were therefore given until at least autumn 1998 to make revisions. In the case of a few chapters, which referred to empirical realities (such as the international oil price)

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<sup>1</sup> G. MacKerron and P. Pearson (1996), *The UK Energy Experience: a Model or a Warning?* Imperial College Press, London.

which were changing very rapidly, we decided to allow authors to May 1999 to make their final corrections.

The theme of the conference had been the international experience of change in energy systems in recent years, with a particular focus on the interplay between markets, regulation (the new guise of much of what used to be known as 'policy') and environmental protection. Papers came from all over the world, and the selection published here covers eight nationalities and three Continents, with a particular emphasis on Europe.

In thinking about this volume and its organisation, we needed to establish some themes which had both run through the conference and which sounded a wider intellectual and practical resonance. We also had to ensure that there were enough strong chapters to illustrate relevant issues within those themes. In the end we chose six main thematic areas, forming the first six sections of this volume. For all but the first theme there are at least four chapters.

### **Theme 1. World Energy Markets**

The essential scene-setting is undertaken in the first section, which contains a single overview chapter on world energy markets from Peter Davies of BP Amoco. This is a comprehensive and lucid piece, covering a wide territory for the period since 1986, the point at which oil and other primary fuel prices started an unmistakable and relatively long-term decline. Essentially the chapter asks what this means, dividing the world into the Former Soviet Union (FSU), where experience has been mostly affected by the break-up of the old central planning system and the uneven process of moving towards a market economy, and the rest of the world, where low fossil fuel prices, a strong trend to liberalised markets and an increasing concern with environmental targets have been the predominant forces.

Davies suggests that the link between primary energy consumption and world GDP has (away from FSU) been firmly re-established since 1986. This immediately poses problems for Governments, which wish to ensure that GDP continues to grow, but which also (in the industrialised countries) have since Kyoto accepted commitments to reducing greenhouse gas, especially carbon dioxide, emissions, by 2008-2012. Contrary to the expectations of the 1970s, the supply of all fossil fuels has held up well at falling cost and price, and reserves seem more extensive now than they did fifteen years ago. Technology has played a large role, both in helping less apparently economic deposits of fossil fuels to be re-classified as reserves, and in cheapening the extraction process. The large growth area has been gas, and FSU energy exports seem set to rise. The analysis in Davies' chapter is carefully marshalled and is a well-supported example of a widespread industry view that energy supply will remain plentiful.

## **Theme 2. National Studies of Energy Structure and Reform**

In the 1990s there has been reform activity, some of it radical, in the energy industries of almost all countries. The main activity has been in electricity systems, possibly because in a general climate of worldwide liberalisation, electricity often seemed to have the greatest distance to travel - electricity industries have most often been state-owned and heavily monopolistic. While there are important natural monopoly elements in electricity (the network or transport functions of transmission and distribution) many countries organised their electricity supply as vertically integrated monopolies from production or generation right through to retail supply. A variety of pressures has induced virtually all countries, whether OECD, transitional or developing, to move some way towards liberalisation.

For the industrialised countries, the motivations have been a mixture of a desire to raise cash for Government from privatisation and a conviction that liberalisation would bring benefits from improved economic efficiency. For transitional economies, reform to the energy industries has been part of a wider movement towards the market economy. In the case of developing countries, shortage of state resources for high rates of required investment have often been primary motives, together with pressure from lending institutions like the World Bank to adopt a more market-oriented economy.

While electricity has undoubtedly been in the lead, other energy sectors, including oil and gas, have also been subject to reform, though market pressures were formerly more evident in these energy markets, where trade and competition issues have always been important. In particular, the national oil monopolies of a number of non-OECD producing countries have come under increasing pressure to allow new entrants, and tax regimes have been simplified in a range of countries.

The four chapters in this section of the book illustrate some of these themes. Robinson offers a retrospective on a decade of UK experience, especially in relation to regulation; Arocena explains and analyses the series of reforms to Spain's electricity system; Jasinski provides detailed insights into Poland's electricity reforms; while Andrews-Speed and Dow look at the very wide range of problems affecting the regulation of China's energy system as a whole.

## **Theme 3. Electricity and Gas: Markets and Regulation**

In North America, much of the debate about liberalising the energy utility industries has been conducted around the idea of deregulation. The hope has been that market forces will largely replace not only former structures of Governmental control, but also render the newer (for Europe) 'regulatory' forms of intervention as marginal as possible. Most experiences of liberalisation in electricity and gas have not found it possible to follow such a free market model. Even in countries such as the UK with

a strong ideological commitment to deregulation and the flourishing of the free market, it has not proved possible to allow the State to withdraw to the passive role that had been hoped. While there has been progress towards making markets substantially more competitive both in the production or generation of energy and in its retail sale, most electricity and gas markets remain quite heavily regulated.

There seem to be a number of reasons for the difficulty experienced in moving towards 'free' as opposed to competitive markets. The first is the obvious one that the transport functions for both electricity and gas remain natural monopolies and are therefore inevitably subject to quite strict regulation (of profits, prices or some hybrid). A second is that in most countries the companies involved in the potentially competitive parts of the energy utility businesses retain large amounts of market power, so that for orthodox competition policy reasons, public intervention remains important here as well. However there are social as well as narrowly economic reasons for continued public control of gas and electricity. One is the sensitivity of many electorates to increases in the retail price of gas and electricity, increases that often seem required by the need to make the industries financially viable, especially in transition and developing countries. The other, much more strongly evident in the OECD countries, is that both gas and electricity - but especially electricity - are deeply implicated in major environmental issues, notably acid deposition and currently climate change. This implies close environmental regulation.

The four chapters in this section of the book tackle different aspects of these questions. Morrison expounds the various possible ways in which wholesale electricity trading can be organised (and controlled); Dixon and Easaw explore some theoretical questions in the interaction of regulation and competition in the UK contract gas market; Acutt and Elliott explore some problems for regulation of low levels of competition in electricity generation markets; and Haas offers the provocative forecast that liberalisation is unlikely in the longer run to make electricity cheaper for consumers.

#### **Theme 4. Oil Markets and Regulation**

Despite the large international market power of the oil majors, oil markets are often thought of as highly competitive, and more 'free' than those for the supply of gas and electricity to final consumers. While such views have weight, it is also true that oil markets are subject to a substantial body of regulatory activity, much of it concerned with unique sectoral tax policies but also covering a range of other issues including the licensing of exploration (administrative versus auctioning rights) and the ability of the majors to compete in protected national oil markets especially in the developing world.

In addition, as Peter Davies has noted in the opening chapter, there has been a very rapid rate of technological change in the oil industry in recent years, both in exploration and in production. The result of this intensive activity, relatively scantily reported in the public domain, has been that the production costs of oil and gas, especially in offshore waters, have fallen dramatically. This has shielded the industry at least in part from the impacts of much lower wholesale oil and gas prices. It has also rendered small, previously uneconomic deposits worth exploiting even in this regime of lower prices. Technology change and falling prices have also made many governments re-consider their fiscal policy towards the industry. This has been true both in producing countries, where the pressure has been to relax the stringency of earlier tax regimes as the level of economic rents falls sharply, and in consuming countries, where falling wholesale prices have given headroom for higher tax takes, often justified in environmental policy terms.

The four chapters under this theme look at different elements of all the issues just described. Watkins provides a statistical analysis of trends in supply functions as between OPEC and non-OPEC countries; Frewer explores efficiency and other issues around administrative discretion versus auctions as a basis for allocating exploration rights; Martin tries to explain developments in UK oil production in terms of the roles of technological change and reform in fiscal incentives; while Kemp analyses interactions between investment activity and taxation under different oil and gas prices.

## **Theme 5. Renewable Energy**

Renewable energy has traditionally meant either hydro-electricity (usually in large schemes) or the use of biomass (often quite inefficiently) in many rural parts of the world, especially the developing countries. However, a combination of new interest in a much wider range of renewable energy sources as one response to a need for a less carbon-intensive energy economy, and some technological advances in renewables such as wind and photovoltaics, has led to a much more prominent role for renewable energy in the 1990s, and the prospects for further expansion in the 21st century.

While renewable forms of energy have been getting cheaper, sometimes quite rapidly, most are not yet competitive with fossil fuel-based energy systems. This means that the growth in investment in renewables has been heavily dependent on various forms of subsidy. A wide range of policy instruments has been developed in the last decade in an attempt to bring new forms of renewable energy into the market place at low cost and in ways which provide incentives for costs to fall as rapidly as possible. Bearing in mind that most renewable energy has developed in forms where it is converted to electricity there have also been important techno-economic and regulatory questions about the possible problems of integrating

intermittent renewables into grid systems where reliability is vital. More recently, such debates have moved in a new direction in which the possible advantages to grid systems of small plants located close to load centres ('distributed generation', not necessarily renewables) have been explored.

The much expanded interest in renewable energy is reflected in the presence of four chapters in this section. Mitchell asks how well the innovative UK policy to support renewables (based on a competitive model) has worked; Skytte looks at some grid integration issues for renewable energy; Fouquet explores the issue of the extent to which there is a definable demand for specifically renewable energy and how large this demand might be; and Madlener engages in modelling to explore the potential contribution of renewable energy in the UK to 2020 and what first-order economic and environmental impacts might flow from such a development.

## **Theme 6. Environment and Energy Efficiency**

In the course of the last 15 years or so, energy policy has been increasingly colonised by environmental policy. For the OECD countries especially, environmental policy has come to occupy a more and more prominent role in the general domain of public policy, and because so many environmental problems derive largely from the energy system - especially those involving air pollution (including acid deposition and climate change) - environmental needs have rivalled liberalisation as a major driver of energy policies.

Environmental (and ecological) economics has been a major growth area as a consequence of the increasing prominence of environmental policy, and because of the focus on energy systems, environmental economics and energy economics have moved closer together. The issues to be analysed are immensely complex, and only a few are described here. The general umbrella idea of sustainability is a starting point for many of the more specific questions. Climate change has now moved to centre stage, and this has created large interest in mechanisms (especially emissions trading) that might efficiently allow large reductions in greenhouse gas emissions. At the level of political economy, it also raises questions of the utility of reducing emissions in OECD countries while developing countries such as China and India remain outside the control regime. Complementarities or conflicts between the liberalisation agenda and the environmental control agendas are also a major issue. The extent to which nuclear power is a sustainable option also excites much controversy, and the issue of environmental valuation remains a large and difficult area.

The six chapters in this section illustrate some of these themes and raise other issues as well. Bailey and Clarke examine the large question of the relationship between China's energy development and its environmental impact; Bristow tackles the difficult issue of appropriate ways to evaluate transport investment in the context

of environmental objectives; Pearson looks at the interactions between liberalisation and environmental policy (especially air pollution) in the UK; Stirling raises basic issues of appropriate ways of evaluating environmental damage; MacKerron and Sadnicki ask whether or not current nuclear clean-up policy in the UK satisfies practical sustainability criteria; while Eyre tackles the question of whether or not liberalisation can be expected to help or harm movements towards greater energy efficiency (also one of the more obvious ways to reduce pollutant emissions).

The final section of this book is a masterly summing up of some major themes from the chapters in this book from David Newbery. It would be redundant to provide here a summary of a summary; but for a personal and highly readable analysis of some of the principal issues emerging across all our themes, the reader is recommended to turn to Chapter 25.