IAEE INTERNATIONAL ASSOCIATION FOR ENERGY ECONOMICS

IAEE Newsletter

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President's Message

WITH THIS ISSUE of the Newsletter, we are fast approaching the end of the 20th century. This century was the age of fossil fuels, with petroleum in preeminence. Vast infrastructure and technology were built around petroleum. Economic growth meant growth in fossil fuel consumption. The stages of economic growth reflected transformation of energy configuration, from non-commercial renewable energy sources to coal, and then to oil and natural gas.

Now, at this turn of the century, the fossil fuels are under attack because they are primary sources of global warming and climate change. The Kyoto Protocol, notwithstanding uncertainty of its ratification, reflects world community's concerns about the need for collaboration for global reduction of greenhouse gases and ultimately the reduction of fossil fuel consumption. The new century's energy need is likely to be filled increasingly by something other than fossil fuels. How can we make this transformation with least cost? What role markets and government play in the transformation? How can we facilitate technology development and diffusion? The energy economist must be busier than ever in the 21st century. Whether we were wrong about oil price forecast or not, more serious tasks await us than making price forecast.

I am happy to report you that the preparation for the Sydney Conference next year is well under way. Your input and participation will always be valuable. In this fall, we had two regional conferences: USAEE's North American meetings in Orlando, and BIEE conference in Oxford. Both attracted large participants from domestic as well as international. Both meetings were valuable in assessing the state of art in energy economics and public policy development.

Beginning from January next year, Peter Davies will become the IAEE President. Peter will provide us new insights, intellectual vigor and leadership. My best wishes for Peter. I also express my thanks to Council members and Charles Spierer, the immediate past President. Their service and fellowship will be most cherished. And finally, my thanks go to our members. I wish all of you a very prosperous future in the new century.

Hoesung Lee

Editor's Note

Robert Weiner opens this issue with an insightful article on the myths and realities of the energy futures markets. He looks at ten generally held conceptions regarding the markets and then points out the realities of the situation. He concludes that much of the energy trade press discussion of futures trading is simply wrong. Read on for more detail.

Peter Davies looks at how the world petroleum industry has changed as it has moved from a group of seven major players plus a group of other integrated companies plus independents to three super majors plus a myriad of other players, many of whom where outside the petroleum sphere only a few short years ago. He examines how this broadening of the industry has occurred and how the drivers of competitive advantage have changed.

Dieter Helm traces energy policy in the United Kingdom from 1979 to the present, noting that the 1979 election brought with it a major shift in energy policy that started a transition that is ongoing. He notes the policy changes introduced by succeeding officials responsible for energy and how some have added clarity while others have muddied the waters. He concludes that even when energy is cheap and abundant, politics will continue to play a key role as energy is, next to labor, the main input of all economic activity.

Roger Bentley and a group from the University of Reading challenges the idea that an ultimate oil shortage is scare-mongering. He presents the case for a peaking in world oil supplies and the implications of the adjustments to this.

Gerald Westbrook reports on a debate on global warming that brought together seven internationally known global

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23rd ANNUAL IAEE INTERNATIONAL CONFERENCE

Hilton Sydney Hotel, Sydney, Australia, 7-10 June 2000

Theme

Energy Markets and the New Millennium: Economics, Environment, Security of Supply

The year 2000 is an ideal time to reflect on the dominant role of fossil fuels over the past century and assess how this pattern of reliance will change in the context of the liberalisation of energy markets and environmental pressures and concerns. This conference will consider: electricity market liberalisation: international experiences and expectations; the economics of renewable energy technologies; Asian energy markets and macro-financial management; liberalisation of international trade in energy resources; the geopolitics of energy supply: social, cultural, political and philosophical dimensions of energy sector restructuring; transport policy in the new millennium; and carbon sequestration and recycling.

Sydney (the Olympic City in the year 2000) has many attractions for both participants and accompanying persons, in addition to the world famous Harbour Bridge and Opera House. City and harbour tours are readily available, while longer trips into the Australian "bush" can be made with a hire car. World class vineyards are just two hours drive to the north of Sydney, sharing the area with some of Australia's largest open cast coal mines. The nation's capital, Canberra, is a 40-minute flight to the south of Sydney.

CALL FOR PAPERS

Deadline for Submission of Abstracts: 7 January 2000

Abstracts should be between 300 and 500 words, giving an overview of the topic to be covered. Full details, including the title of the paper, name of the author(s), address(es), telephone, fax and email numbers, should also be sent. At least one author from an accepted paper must pay the registration fee and attend the conference to present the paper. Anyone interested in organising a session should propose topics, objectives and possible speakers to the Programme Chairmen well in advance of the deadline for submission of abstracts. All abstracts, session proposals and related enquiries should be directed to:

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23rd Annual International Conference of the IAEE
Department of Econometrics, Sydney University
Sydney, NSW 2006, AUSTRALIA
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Deadlines

Abstract Submission Deadline: 7 January 2000
Notification of Abstract Acceptance: 1 February 2000
Manuscript Submission Deadline: 1 March 2000

Editor's Note *(continued from page 1)*

warming scientists to discuss the science of global warming. At the end of the debate the seven were asked if they would sign the Kyoto treaty. The results are fascinating. Read on.

Jean-Marie Bourdaire discusses the costs of Kyoto and how industry can survive in a post-Kyoto environment. He concludes that the costs to industry of the Kyoto agreement are considerable and that in order for industry to move fast on the issue, governments need to deliver clear signals. He favors a modest penalty for noncompliance and tradeable quotas.

Gordon MacKerron sums up the September BIEE conference in Oxford, England, noting that the debate was sharp and sometimes included a very political edge. He attributes this to the current prominence of mergers and takeovers and that environment regulation has at least become a serious issue for many governments and energy companies.

Fereidoon Sioshansi comments on the German power industry's final acceptance of competition and the unparalleled changes this has set forth. He notes specifically the consolidations and price cutting that has occurred and wonders about the eventual outcome.

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Manager-Energy & Financial Markets Analysis

EOG Resources, Inc. has an immediate opportunity for a Manager-Energy & Financial Markets Analysis. This person will serve as a primary supplier of information to senior management for the assessment of current and longer-term trends in the natural gas market. Utilizes a variety of industry sources for obtaining and maintaining current industry information including records on production in the North American producing regions, storage in producing and consuming regions, consumption relating to the energy industry, and drilling data pertaining to wells currently in the process of being drilled. Prepares regular studies focusing on supply and demand trends in the North American natural gas market. Makes recommendations based on analysis of collected data as to the company's capital investments and hedging strategy. Provides analytical support on certain corporate finance matters, including debt capital markets analysis, structured financing analysis, corporate commercial banking relationships, rating agency relationships, and special projects as necessary. The position requires a Bachelor's degree in a quantitative discipline or a Master's degree with a quantitative focus is required. Five or more years industry/financial analysis or equivalent related experience preferred. Excellent PC skills including Microsoft Word, Excel, etc. Salary commensurate with experience. Relocation available. Interested candidates can fax, mail or e-mail their resumes to: EOG Resources, Inc. 1200 Smith Street Houston, TX 77002 Attn: Kyla Laird, Fax (713) 651-6995, or e-mail Kyla_Laird@Enron.com

New Director for EDRC

The Energy and Development Research Centre (EDRC) in Cape Town is one of Africa's leading policy research, consultancy and capacity building institutions. It is committed to contributing to transformation and improved social equity, economic efficiency and environmental sustainability in the energy sector through generating and communicating knowledge and understanding as a resource for better policy making and implementation.

EDRC is being restructured. While remaining in association with the University of Cape Town, it is being formed into a not-for-profit NGO. Professor Anton Eberhard, who has led EDRC for the past 10 years, will remain in the university, contributing to the academic programme in Energy and Development Studies and concentrating on his national and international commitments in the energy sector. We are looking for a new Director who will lead EDRC into the new millenium.

The Director is responsible for: co-ordinating the strategic direction of EDRC; overall management of EDRC's research and advocacy through supervision of EDRC programme leaders; maintenance of external relations with major research clients and users; fund raising; supervision of EDRC's Manager who looks after finance, contracts and HR systems; and management of general institutional communications and networking.

We are looking for someone who: is a dynamic leader; has experience in managing research; has a commitment and interest in utilising research knowledge to make a difference in social, economic and environmental policy; is a confident networker; and manages people well. We have a strong preference for an African candidate.

Postgraduate Programme Convenor

EDRC is also looking for someone who will convene our Masters programme in Energy and Development studies. The candidate should preferably have a PhD and a commitment to academic and teaching excellence.

APPLICATIONS

Visit our website at www.edrc.uct.ac.za to find out more about EDRC.

Detailed job descriptions for the directorship and postgraduate programme convenor will be posted on the site in early October.

Inquiries should be directed to Shireen Arnold, EDRC, UCT, Rondebosch 7701, Cape Town. Ph +27 21 650 2834 Fax +27 21 650 2830 email: shireen@energetic.uct.ac.za. Applications should be submitted by December 15, 1999 and should include a full curriculum vitae, the names and addresses of two referees and a covering note motivating your application.

Energy Futures Markets – Myths and Realities

*By Robert J. Weiner**

The IAEE Newsletter ought to provoke some controversy. In the case of energy futures markets, this should not be very difficult; much writing on the subject is prone to fallacy and even foolishness. In this article, I examine common myths about energy futures markets, with an eye toward correcting popular misconceptions, increasing understanding, and generating discussion. The views presented here are strictly my own, but I have benefited over the years from extensive discussions about energy futures markets and pricing with Ed Krapels and Phil Verleger; Mike Lynch and Michael Pratt provided helpful comments on earlier versions of this article. Citations are to articles published under IAEE auspices when possible.

Note: the names of the exchanges trading energy futures contracts are abbreviated below: CBOT – Chicago Board of Trade, COMEX – Commodity Exchange, IPE – International Petroleum Exchange, KCBT – Kansas City Board of Trade, MGE – Minneapolis Grain Exchange, NYMEX – New York Mercantile Exchange, SIMEX – Singapore Monetary Exchange.

MYTH I: Energy Futures Markets Are New

Energy futures markets are widely described as part of the worldwide economic and financial liberalization of the last twenty years (see e.g., Deaves and Krinsky [1992]). In fact, crude oil futures trading was extensive in North America in the early years of the petroleum industry. For about a quarter-century starting in 1870, crude oil futures were traded on about two dozen exchanges in the United States and Canada. In the early part of this period, trading was primarily concentrated in Pittsburgh and the small towns of the oil regions of western Pennsylvania, but later the action shifted to New York.

In the era before the current distinction between stock and commodity exchanges, "pipeline certificates" (as futures contracts were known) were even traded on the New York Stock Exchange. By the mid 1890s, the current North American system of "posted prices" had replaced exchange trading, and the oil exchanges were soon forgotten. The 1930s witnessed a second era of petroleum futures trading, with listing of crude oil and gasoline contracts on COMEX (now part of NYMEX). The absence of oil price fluctuations resulted in the failure of these contracts, which were delisted in 1942. For detailed historical and economic analysis of oil futures trading, see Weiner [1992,1998b].

Futures trading in natural gas and electricity, in contrast, is indeed new.

MYTH 2: Energy Futures Contracts Are Mostly Successful

Most new futures contracts, like most new products in any industry, fail. For example, prior to the introduction of its successful cash-settled Brent crude-oil futures contracts in 1988, the IPE had twice introduced unsuccessful Brent contracts calling for physical delivery. NYMEX's Henry Hub LA natural-gas contract has been very successful, but its natural-gas contracts for delivery in the Permian Basin and in Alberta have failed, as has its sour-crude contract for U.S. Gulf Coast delivery; KCBT's western natural-gas contract is moribund. SIMEX has introduced several unsuccessful petroleum contracts, including Dubai crude oil, fuel oil, and gas oil.

The definition of "successful" itself is subject to interpretation. While the failed contracts listed above have ceased to trade, a number of energy futures contracts trade at low levels. In order to receive detailed coverage in *The Wall Street Journal*'s futures pages, a contract must trade at least 1000 lots per day, and have an open interest of at least 5000 lots. Although this threshold is relatively low (for example, NYMEX crude oil averages over 150,000 contracts traded per day, with open interest over 600,000 contracts), only six energy futures currently (Summer 99) exceed the threshold – WTI crude oil, eastern natural gas, heating oil, and unleaded gasoline on NYMEX, and Brent crude oil and gasoil on IPE. None of the new electricity contracts listed on NYMEX, CBOT, or MGE come close.

MYTH 3: Energy Futures Trading Has Wrested Control over Pricing away from OPEC

OPEC's ability to maintain prices depends on three factors – internal cohesion (members honoring their quotas), external competition from non-OPEC members, and availability of alternative fuels and conservation. While the petroleum industry increasingly looks to the futures markets for pricing information, this should not be confused with influence over supply and demand (e.g., Edwards [1999]). Similar statements, such as "OPEC no longer sets prices; speculators do" are just as fallacious (speculation is discussed in more detail below).

MYTH 4: Futures Trading Results in Lower Oil Prices and Greater Volatility

Markets are a convenient scapegoat of those who do not like their message, especially because markets do not vote, complain, lobby, or make political contributions. Just as farmers have long claimed that futures markets were hurting their business (and indeed have succeeded in having onion futures trading banned in the United States since the late 1950s), so too have oil producers blamed the market for low prices. An early (1878) attempt to raise prices by limiting production was made by the Petroleum Producers' Union, which listed among the causes of low prices "the manipulation of the stocks by speculators and buyers to suit their purposes, which are always adverse to the interest of producers" [Petroleum Producers' Union, 1878].

In fact, every futures contract has a seller and a buyer, making the claim that futures trading affects the *level* of prices difficult to support. The analogous claim that futures trading exacerbates price *volatility* is also widespread. For example, "The cost [of speculation in futures markets], as the academic literature has begun to recognize but as practitioners in financial markets have long known in their bones, is volatility" [Krapels 1999].

While not farfetched, such claims are difficult to assess because they are seldom backed up by evidence. Indeed, turbulent periods in energy markets are characterized by both high volatility and increased trading activity, but this association need not imply that the latter causes the former. A certain amount of skepticism is in order here – futures

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markets are *visible*, which makes them a target during crises. It should be recalled, however, that spot markets played an analogous scapegoat role during the energy crises of the 1970s, when futures trading was not a factor (see e.g., Danielsen [1984]).

Defenders of futures markets, in contrast, tend to assume reverse causality – market turbulence creates the need for more hedging, as well as speculative opportunity, and hence, more trading. According to this view, futures markets help smooth the industry adjustment to disruptions. Evidence in favor of this assumption is similarly scant.

The modern finance view allows for two fundamentally different reasons for the widely observed correlation between trading activity and volatility. First, both trading and volatility are seen as outcomes of news about current and future supply and demand conditions, rather than a causal relationship. Second, the trading process itself may generate volatility, either through "noise trading" (e.g., trading decisions based on charting – extrapolation of past price trends), or through "herding" (traders copying each other's behavior).

The impact, if any, of futures trading on volatility, can only be assessed through empirical investigation. Distinguishing "news" from "noise" as a driving factor behind volatility and trading activity is tricky, however, and relatively little progress as been made. A study of the Gulf Crisis, which witnessed tremendous increases in trading and volatility, and relatively little obvious change in production and consumption, concluded that trading indeed increased volatility in the crude oil market in the periods before and after the Crisis, but not during the crisis itself [Weiner 1998a]. Evidence on herding is discussed below.

MYTH 5: Energy Futures Markets are a Sideshow, Having Little to do with the Energy Business

A quite different claim is sometimes heard – futures trading has nothing to do with the energy business, and has no influence on the industry. Futures traders are widely perceived to be ignorant about energy production, refining, distribution, etc. For example, according to Edwards [1999], "The reasons why [futures-market] professionals take a buy or sell stance is not based on their understanding of the oil supply/demand situation because they have no real knowledge of this and in addition, they don't care." While it is difficult to administer an exam to participants in futures markets, it is nonetheless instructive to examine the list of the companies that are members of NYMEX (as of Summer 99), as membership is necessary to trade futures and options on the exchange. Among the companies whose names ought to be recognizable to IAEE members are (alphabetically, A-E only): Amerada Hess, Arco, BP Amoco, Chevron, Cinergy, Coastal, Conoco, Duke Energy Trading, El Paso Energy Marketing, Elf, and Enron.

MYTH 6: Energy Spot Prices are "Real;" Energy Futures Prices are "Speculative"

i) Energy Spot Prices Reflect Current Supply and Demand; Energy Futures Prices Reflect Speculation Regarding Future Supply and Demand

Except for electricity, energy is storable. As for any storable commodity, *both* spot *and* futures prices reflect not only current but also expected future supply and demand conditions – thus if "paper" trading affects "paper" prices, it affects "wet-barrel" prices as well. For example, news of a likely end to sanctions against Iraq three months in the future would indicate increasing availability of future supplies, depressing futures prices now and reducing inventory levels now. The inventories released augment current supply, depressing spot prices also.

MYTH 7: Causal Relationships between Inventories and Futures Prices

i)Lower Inventory Levels Result In Backwardation (Spot Prices above Futures Prices)

ii)Backwardation Tends To Reduce Inventory Levels

Energy futures prices are closely related to inventory levels. Beyond this statement, however, there seems to be much confusion. According to the first view, low inventory levels reflect current scarcity, and hence push up spot prices. The further into the future one goes, the less relevant are inventory levels for prices. The second view is accompanied by the claim that holding inventories is uneconomic when futures prices are below spot prices, since it implies that prices are expected to fall, resulting in a capital loss on inventory held. Thus companies seek to reduce their inventories as much as possible.

It should be clear that these views cannot both be true, since the resulting explanation would be completely circular. Unfortunately, such is not the case, judging by the frequency with which these arguments are encountered. For example, "expected [crude oil] price drop discouraged stock building" [Bohn 1997]; "storage gas utilization practices appear to have been a major factor in determining prices in 1996-97" [Trapman and Todaro, 1997]. There is indeed a close relationship between inventory levels and backwardation, often referred to as the supply of storage – low inventory levels are associated with greater backwardation. Nevertheless, neither claim is true. Both views suffer from the fundamental fallacy that price relationships and inventories are causes, or drivers, of market relationships. They are not.

Instead, a correct statement would be that both backwardation and inventory levels are outcomes of shocks to current and expected future supply and demand. For example, an unexpectedly cold winter would deplete heating oil and natural gas stocks, and raise spot prices of these fuels relative to futures prices. Also correct is the statement that news about inventories (e.g., the weekly API petroleum-inventory report) can affect price spreads, but this is because revelation of the size of inventory changes helps traders infer the size of these shocks, which are not directly observable.

Unfortunately, these views are reinforced by so-called "tests" of the supply-of-storage theory, which typically entail regression of price spreads on inventory levels (see Cho and McDougall [1990]) or inventory levels on spreads (see e.g., Zyren [1995], who concludes "stock level of gasoline relative to normal levels seems to be the important variable in explaining short-term gasoline spread movements"). These regressions suffer from "simultaneity bias" in the language of econometrics, and the interpretation of their results is unclear.

MYTH 8: Hedgers are the "Good Guys," Speculators are the "Bad Guys"

i) Hedging is behind most futures trading

ii) Futures trading is mostly speculation; little hedg-

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Energy Futures Markets *(continued from page 5)*

ing takes place

iii) Companies in the energy business hedge; "outsiders" speculate

As in all futures markets, commercial players (those involved in the energy business), tend to put on and adjust hedges when their underlying exposure changes, typically periodically. In contrast, speculators may adjust their positions when their expectations, exposure, or capital-base changes, typically frequently. The bulk of futures trading is among locals – members trading for their own accounts on the floor of the exchange [Manaster and Mann 1996].

The opposite view is no more accurate; commercial players hold the vast bulk of futures contracts, referred to as "open interest." Speculators tend to reverse their trades quickly; many are "day traders," closing their entire position by the end of each day. Not surprisingly, commercials often hold their positions open until hedges are no longer needed.

The assumption (often implicit in the trade press) that energy companies that hedge hedge all of their exposure is not only false, but also ill advised. Even companies that wish to minimize risk usually should hedge less than 100 percent of their cash positions. The risk-minimizing hedge ratio depends on the relationship between spot and futures price changes.

Also inaccurate is the view that risk minimization is energy companies' only objective in trading futures. A few years ago I asked a few traders for large oil companies whether they ever engaged in speculation, and received a negative response; they were not permitted to speculate. I then asked them whether they tried to cover all of their cash-market exposure. "Of course not," was the reply; they were in the trenches buying and selling every day; had a good feel for where the market was going; and looked for opportunities to make money.

I hope that the two preceding paragraphs provide a sense of the difficulty in identifying (and hence, managing) differences between trading for speculative vs. hedging purposes. A good case-study for these issues in practice is the Metallgesellschaft debacle of 1993; much has been written about whether the U.S. subsidiary of the German conglomerate was following a sensible hedging strategy in the petroleum futures markets, and even whether the company's strategy was hedging or speculation (a brief introduction to the debate can be found in Barcot et al [1998]; see also Verleger [1999]).

The role of noncommercial players in energy futures markets has received a great deal of scrutiny in the past few years. In response to pressure from the U.S. Department of Energy, the chairman of Amerada Hess pointed to speculators as responsible for heating-oil price increases [Sullivan 1996] . In a series of consulting reports and articles in energy publications (only the latter are cited here), Krapels [1995, 1996, 1997, 1999], and Verleger [1995] have related speculative activity to price fluctuations in petroleum markets (see also Dale and Zyren [1996]). Utilizing *Commitments of Traders* (*COT*) data (described below), they demonstrate a strong correlation between aggregate non-commercial net open interest and the level of oil prices. These findings have received attention in the trade press [e.g., *PIW* 1995, 1998, Arnold 1995, Keefe 1996, 1998], and have been used to support positions held by both industry supporters and detractors of futures markets.

These articles have helped to focus attention on entry into energy futures markets by large, sometimes well-capitalized speculators – commodity pools and hedge funds. The concern is whether these funds have a positive or negative effect on market functioning. The answer comes down to whether the funds can be characterized as "smart money," undertaking extensive analysis on possible changes in future industry, macroeconomic, political, etc. conditions and their likely consequences for prices. If so, their presence would help smooth market adjustment to these changes.

On the other hand (after all, I am an economist!), if funds represent "dumb money" – noise traders chasing trends or herding sheep, buying and selling because others are doing so, they would exacerbate volatility. Only if speculators are not reacting to expected changes in fundamentals can they meaningfully be said to be "causing" prices to rise or fall. As the result of the recent near bankruptcy (and bailout by some of its lenders) of the hedge fund Long-Term Capital Management, however, the funds are no longer just assumed to represent "smart money", raising the specter of a destabilizing influence in financial markets.

The answer cannot be determined without evidence, which does not prevent analysts from holding strong views on the subject. For example, according to Krapels [1999], "Of the hundreds of fund managers and commodity traders, the vast majority are 'systems traders,' relying upon the analysis of price trends for their trading decisions, and paying little, if any, attention to the fundamentals of the markets in which they are trading." While Krapels's statement is consistent with his view (cited earlier) that speculators are a source of volatility, the same cannot be said about Dale and Zyren [1996], who claim that aggregate data shows that funds are price followers (termed "sheep" by *PIW* [1995]) rather than an influence on prices. Even if their analysis showed such to be the case (which it does not, as pointed out by Krapels [1996], who notes "occasionally there is a wolf under that wool"), their reassuring interpretation is backwards, reflecting a complete misunderstanding of the discussion above. If these be sheep, then one is safer among wolves!

Unfortunately, in the absence of disaggregated data, the widely observed correlation between price fluctuations and changes in non-commercial positions implies little about the profitability of such positions, the effect of speculation on market efficiency and volatility, or whether this phenomenon is a cause for concern in the industry. Interpreting these relationships requires information on individual-trader behavior, to which we now turn.

iv) Speculative "herding" is an important phenomenon in energy futures markets

As noted above, it is often assumed that funds and other speculators have a tendency to "herd" or act like "sheep," trying to buy and sell at the same time as a consequence of using the same models or copying each other's trading strategy. The consequence is increased price volatility. This is an empirical question, impossible to address without data on individual speculators' positions.

As part of its oversight and monitoring role as the regulator of futures markets in the United States, the U.S. Commodity Futures Trading Commission (CFTC) compiles position data for large commercial and noncommercial users

of futures and options contracts (which under the U.S. Commodity Exchange Act are required to report their open interest each day they hold a large position), but ordinarily makes them public only in aggregate form, as part of its biweekly *COT* report (see Krapels [1999] for details). As part of a U.S. Department of Energy project on the impact of speculation on heating oil prices and inventory levels (motivated in part by the claims noted above), however, data on individual trader positions in heating oil, crude oil, and gasoline were made available for the period 1993-1997 to the author, as well as to Ederington and Lee [1998], who provide a description and summary of the individual-trader data.

Preliminary investigation of these data reveals little evidence of herding behavior among commodity pool operators (CPOs - managers of funds that invest customer money in futures and options markets) with large positions in the heating-oil futures market (250 or more open contracts of 1000 barrels each). If CPOs tend to herd, i.e., to buy and sell at the same time, this should show up in high correlations among their daily changes in open position.

As can be seen in Table 1 (taken from Weiner [1999]), the average correlation among position changes of the 80 CPOs large enough to be in the database (i.e., those holding a reportable position on at least one day during the 1993-97 period) was only about 11 percent. Most of these CPOs are relatively small, infrequent players in this market; the median number of days with a reportable position was only 92 out of 963 trading days during the period covered by the data.

As a result, only about a third of the 3160 possible correlations could even be calculated. Only about one-tenth of the 1115 correlations calculated exceed 50%; the median correlation does not differ from zero significantly at conventional levels. Moreover, the few high correlations tend to be among the smaller players; when attention is restricted to the ten largest CPOs (measured by number of days with an open position of at least 250 contracts), the herding measures are still weaker. The median correlation is again close to zero; only one of the 45 exceeds 50% and only five exceed 30%.

Table 1
CPO Herding in Heating Oil Futures

Number of CPOs		80
Maximum possible number of correlations		3160
	all 80	**largest 10**
Median # of reportable days (out of 963 total)	92	536
Number of correlations	1115	45
Correlation order statistics		
lowest	-100%	-16.9%
5%	-30.4%	-8.0%
10%	-17.4%	-6.4%
lower quartile	-3.5%	0.2%
median	4.7%	2.2%
upper quartile	24.9%	10.7%
90%	50.1%	32.2%
95%	76.2%	38.5%
highest	100%	51.3%
average	***10.9%***	***7.2%***

v) Oil-exporting countries use the futures markets for price protection

While the arguments for government hedging are stronger than those for hedging by private companies (because governments, as agents for nationals of oil-exporting countries, are poorly diversified, whereas investors that hold shares of private companies tend to be well diversified), use of futures for hedging export revenue, tax revenue, etc. by oil-exporting countries is minimal.

While some observers have attributed this to ignorance, it is more likely due to asymmetric rewards to government decisionmakers, in combination with *ex post* evaluation of hedging performance. Locking in a price that *ex post* turns out to be higher than the market price results in a pat on the back, and perhaps a promotion, whereas the opposite result can lead to political difficulties (see Verleger [1993] for a brief discussion of this in Ecuador, as well as Mexico's successful experience). A second factor limiting use by the larger exporters is liquidity – if for example, Saudi Arabia tried to hedge its future oil sales through NYMEX and IPE, the result would be a reduction in futures prices, in order to elicit buyers for the large addition to the supply of futures contracts.

MYTH 9: Futures Markets and Oil Supply Disruptions

i) Futures Markets make Strategic Petroleum Reserves Unnecessary

Making sense out of this claim requires assumptions about why strategic reserves are necessary in the first place. If they are to make oil available to favored groups (e.g., defense-related industry, police, firefighting and sanitation services, public transport, agriculture, low-income households) at low prices during a crisis, then futures markets will not provide it. If they are to make oil widely available to reduce macroeconomic damage from a crisis, futures markets will not help either (except to the extent that those most likely to be seriously affected might seek to protect themselves in advance by purchasing futures contracts). If they are to enable governments to influence prices, raising them when they are low by buying up production, and reducing them when they are high through releases, futures markets are not a substitute, although they may help in making reserve policy more effective (e.g., by making announcements of future releases more credible through selling futures).

ii) Futures trading exacerbates oil supply disruptions

This view was popular during the Gulf Crisis, when there were proposals to shut down petroleum futures trading, either for a "cooling off" period, or indefinitely (a collection of these views were presented at congressional hearings; see U.S. Senate [1991]). According to the trade press [*PIW* 1990], the CFTC considered halting futures trading in petroleum at the time, just as it had briefly closed down wheat trading on the CBOT at the time of the Soviet invasion of Afghanistan in 1979. As noted above, evidence presented in Weiner [1998a] suggests that the enormous increase in price volatility during the Crisis was due to fundamental factors (invasion, war, etc.); futures trading actually played a mitigating role.

MYTH 10: Oil Spot and Futures Prices Follow Simple Patterns

i)Oil Prices Follow A Random Walk

ii)Oil Prices Tend To Revert To A Long-Run Price Of $xx/Barrel

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Energy Futures Markets *(continued from page 7)*

iii)Oil Prices Tend To Rise at the Rate of Interest, à la Hotelling

The inaccuracy of oil-price forecasts and frustrations of forecasters are well known (see, e.g., Lynch [1999]). A natural question to ask is what the pattern of futures prices can tell us about where prices are going. After all, these prices represent forecasts by market participants willing to put money where their mouth is (mouths are?).

Variations on the above three claims are commonly heard among analysts from industry and academia. They clearly cannot all be true. Based on evidence from futures prices, none is true (at least for crude oil, the price of which underlies all energy forecasts). Let's take them one at a time.

The "random walk" theory of price changes in markets for securities, foreign exchange, and commodities was popular in the 1980s. The theory is simple – price changes are inherently unforecastable (because they result from unanticipable future shocks). The best forecast of tomorrow's price (or the price next month, or next year, for that matter) is today's price. The theory is less popular today, but still holds up reasonably well for some markets, notably foreign exchange.

In contrast, commodity prices, including oil tend to be *mean-reverting*, i.e., price changes tend to be partially reversed over time. This is true for two reasons. First, responses to shocks tend to be gradual. On the demand side, for example, the move to greater fuel efficiency and conservation followed the energy shocks of the 1970s. On the supply side, these price hikes led to increased exploration, discovery, and production from areas around the globe. The fact that supply and demand elasticities are higher in the long-run than the short-run implies i) in the short run, most of the adjustment to shocks will occur through price; and ii) in the long-run, more of the adjustment will take place through production and consumption. The result is mean reversion. Second, the shocks themselves tend to dissipate over time, e.g., cold weather returns to normal, wars and political turmoil end, etc.

Evidence of mean reversion can easily be seen by examining futures prices, e.g., in *The Wall Street Journal* or on the Web (for NYMEX, www.nymex.com, for IPE, www.ipe.uk.com). Prices for longer-term contracts move much less than those for shorter-term contracts. Even during the Gulf Crisis, for example, when over a few months nearby crude-oil prices rose from roughly $20 to $40/barrel, then fell back to about $20, longer term prices did not exceed $25/barrel (for a statistical analysis of mean reversion in oil, gas, and coal prices over a long time horizon, see Pindyck [1999]).

Turning to the second claim, a tendency toward mean reversion should not be confused with the idea that oil prices must always return to some underlying "true value." In fact, there is no evidence that any such value exists for petroleum (or any other commodity), nor should there be. If there were such a fundamental value, long-run supply and demand curves would have to remain unchanged (or at least shift out together), and the level of competition in the industry be stable. Given the tremendous technological changes in both production and consumption, as well as ongoing industry restructuring, these assumptions appear farfetched.

Of course, reversion to a fixed price would make forecasting much easier, at least in the long run. Again, a glance at futures prices is sufficient to refute this claim – while prices for long-maturity contracts move less than those for nearby contracts, they do not come close to being fixed. For example, the crude-oil futures price for December 2003 delivery has varied between $16 and $22 per barrel (as of Summer 1999) since it started trading in January 1997.

The third view, based on the seminal Hotelling [1931] model, predicts that the price (net of marginal extraction cost) of natural resources such as crude oil and natural gas will rise at the rate of interest to compensate producers for holding them in the ground. This would be reflected in futures prices in a *contango* pattern – futures prices higher than spot prices. In fact, throughout most of the 1980s and 1990s, crude oil prices have been in backwardation (Litzenberger and Rabinowitz [1995]).

iv) Oil Futures Prices are Useless in Forecasting Future Spot Prices

This view, held by many industry analysts, assumes that energy futures prices are simply irrelevant in forecasting future spot prices. Reasons offered for this view are several – futures markets are a sideshow having nothing to do with the real side of the energy business (see discussion above); futures markets are inefficient; futures prices are biased predictors of future spot prices because futures prices incorporate a risk premium.

The usefulness of futures prices for forecasting is a question that cannot be resolved on conceptual grounds alone. Empirical research (e.g., Dominguez et al [1989], Gülen [1998]) has found that, at least in the case of crude oil, futures prices are unbiased predictors of future spot prices. This implies, for example, that the best guess for the spot crude oil price in December 2003 is the December 2003 futures price prevailing today. While unbiased, the futures-price predictor is imprecise, however; i.e., the variance of prediction errors is high.

v) WTI spot prices and NYMEX nearby futures prices track very closely, demonstrating that the futures market works well

Indeed, spot and NYMEX WTI nearby (i.e., shortest maturity) futures prices are virtually identical, but this is because they are measuring the same thing – prices for future delivery. Unlike petroleum products and crude oil delivered by tanker, the term "spot" in a pipeline delivery system (such as used for West Texas Intermediate, the crude oil traded on NYMEX) refers to one month forward, the soonest it is possible to deliver. For example, the spot price for WTI in June refers to July delivery (until June 25, when the July pipeline delivery schedule is drawn up; afterwards, it refers to August delivery). The nearby futures price in June also refers to July (until June 22, when the July contract expires; afterwards it refers to August).

Thus the concepts "spot" and "nearby futures" in this market are virtually identical, and refer to the same future delivery period for all but three days (at least; sometimes more due to weekends and holidays) each month.

Conclusion

This paper has attempted to bring together and synthesize trade and research views regarding energy futures, focusing on speculation, herding and price volatility. Research writing

on efforts often reveals a lack of familiarity with real-world institutions and practices. Much of the energy trade-press discussion of futures trading is simply wrong. Ideally, this paper should engender more informed debate.■

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The Changing World Petroleum Industry: Bigger Fish in a Larger Pond

*By Peter A. Davies**

The most remarkable characteristic relating to the oil industry is probably the fact that its industrial structure remained largely intact for some seventy years or so, despite a wide range of global changes in markets, geopolitics and technology.

This period of constancy appears to have come to an abrupt end during 1998/99 as a period of corporate consolidation was launched. The first move was the merger of British Petroleum (BP) and Amoco. This has been followed by the proposed acquisition of Mobil by Exxon and a number of other consolidating moves.

What is the Petroleum Industry?

The petroleum industry could once be defined as the set of private sector companies who explore for and produce crude oil and natural gas and refine and market oil products as their main source of business. Some companies undertake all of the above functions–the integrated companies. Others undertake only one or some of them.

The industry can be categorised as follows:

Majors

Large integrated players. Traditionally this comprised Exxon, Royal Dutch/Shell, British Petroleum (BP), Mobil, Chevron and Texaco. Prior to 1984 this group also included Gulf Oil. They were known as the "Seven Sisters". Chevron acquired Gulf Oil in 1984. To some degree a group of slightly smaller integrated companies could be added to this list, e.g., Amoco and Arco and, since their privatisation, Total, Elf and ENI.

Other Integrated

This group is similar to the majors but smaller in size and with less geographical reach. It comprised companies such as Amerada Hess, Conoco, Diamond Shamrock, Marathon, Occidental, Philips, Unocal and Ultramar.

Independents

These are yet smaller companies, most of whom specialise in a single segment. They include, for example, Anadarko, British Borneo, Enterprise, Kerr McGee, Lasmo, Ramco, Saga and Talisman.

This definition of the petroleum industry thus explicitly excludes all state owned petroleum companies. These include large state producing companies such as Saudi Aramco, Petroleos de Venezuela, Pertamina of Indonesia from OPEC and non-OPEC state producers such as Statoil of Norway, Petrobras of Brazil, Pemex of Mexico and Petronas of Malaysia.

This definition of the petroleum industry also specifically excludes electricity companies and most gas marketing companies.

A key theme of this paper is that this traditional definition of the industry has become too narrow. The petroleum industry is progressively including state companies and, to some degree, gas marketing and power companies.

Emerging Forces for Change During the 1990s

Structure and Forces Prior to the 1990s

The structure of the private sector oil industry remained extraordinarily stable from the 1920s until the late 1990s.

Up until the demise of Gulf Oil in 1984 the private sector oil industry was characterised by a core of seven firms–the "Seven Sisters." From 1950 the Majors consistently increased their asset base. Those that conspicuously failed to replace lost Middle Eastern assets were soon to become troubled. The failure of Gulf Oil to replace Kuwaiti production and its subsequent demise was evident.

The nationalisation of upstream assets in the Middle East and elsewhere was a fundamental blow to the Majors who had been the leading players in most of the Middle East and other OPEC member states. However, the Majors survived (with the eventual exception of Gulf Oil) and to some degree prospered. They remained at the forefront of the private sector industry through the 1970s and 1980s.

Sources of Competitive Advantage

The 1990s proved to be a period when forces began to build which eventually led to important changes in the structure of the industry. The leading positions of the Majors had been reinforced for a long period by their deep rooted sources of competitive advantage. These were reflected in a set of 'strategic assets' that advantaged the Majors relative to other private sector players. These included:

Upstream: these were mainly large, low cost oil and gas fields. Initially they were mainly in the Middle East. They were then partially replaced by large North Sea and Alaskan fields.

Downstream: the main strategic assets were advantaged refineries and significant retail positions in key markets. Most of the industry's refining assets, at least in OECD countries, were commissioned prior to the 1980s. Advantaged real estate and scale economies had been secured.

Petrochemicals: strategic advantage in petrochemicals has tended to stem from technology, location and feedstock access.

Corporate: in a world of imperfect and heavily regulated capital markets, financial strength proved a source of competitive advantage.

These strategic assets were sustained by a number of key characteristics, for example:

Technical skills and the ability to innovate: the Majors have remained at the forefront in their abilities to apply the best technology and innovate in new applications.

Highly effective *logistical skills.*

Reputation and relationships: the Majors had critical strong relationships with both home and host governments, suppliers and customers.

New Competitive Forces

The 1990s witnessed a build-up of forces that has eventually led to a restructuring of the industry through

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consolidation. The main elements of these forces included:

- natural ***maturity*** of previously advantaged fields. The "endowments" of the Majors, especially in the upstream began to erode. Big fields matured and began to decline. Equally, the Lower 48 states of the United States was also in decline.
- tighter *ex post* upstream ***fiscal terms*** for new fields and new provinces.
- the entry of ***state oil companies*** into downstream markets.
- the ***privatisation*** of previously state owned oil and gas companies, e.g., Total, Elf, ENI.
- changing ***geography***. The fastest growth occurred in non-OECD markets, especially Asia.
- international ***financial markets*** deregulated, giving many private and state oil companies increased access to capital.
- ***intermediate commodity markets*** developed which effectively disintegrated the oil industry on an operating basis. This gave the opportunity for new entrants to enter specific parts of the previously integrated value without being disadvantaged.

At the same time, and partly as a result of a number of these factors, the real price of oil and refining margins fell on a trend basis as supply growth outpaced demand growth. Petrochemicals margins also fell. A renewed deep downswing in the chemicals cycle developed.

The pressure of these forces can be seen by the fact that the petroleum industry was relatively unsuccessful in generating earnings growth and in achieving above average returns for shareholders.

Initial Responses

The industry attempted to respond to deteriorating performance in several ways:

1. *Cost cutting*. Cost reductions at corporate levels and in operating assets was the prime response. Upstream costs were successfully reduced, often through operating and technological innovation. Technological advances included horizontal drilling, subsea completions, floating production systems, seismic data processing, etc.
2. *Portfolio Restructuring*: non-core businesses were shed as petroleum companies went "back to basics". Most coal and minerals operations were sold.
3. At the same time, some companies also entered new sectors that opened in the face of deregulation. U.S. gas marketing attracted Chevron and Shell purchased Tejas. Others invested in the electric power sector, mainly generation and usually IPPs. In the majority of instances these investments have either proved unrewarding or slow to generate adequate returns.
4 *Focus on New Growth Areas*: U.S. companies in particular sought new business opportunities outside their core U.S. markets. Many U.S. upstream companies invested in the UK North Sea. Most companies declared a strategic intent to invest in Asian growth markets. Few had any success. The Former Soviet Union proved to be particularly challenging.
5 *Financial Management:* shareholder returns were enhanced in several cases through share buy back schemes.

Cost cutting, portfolio highgrading and shareholder buybacks were the most successful responses. Attempts to grow organically generally proved less rewarding. In total the petroleum industry continued to underperform relative to the S&P 500.

Sectorial Consolidation

As it became progressively clear that the four strategic responses outlined above were insufficient, a number of companies began, independently of each other, to develop and implement a new strategic response through structural change–sectorial consolidation.

The first major move was by BP and Mobil who merged their European oil refining and marketing assets and lubricating oil operations. This permitted cost cuts through elimination of duplication. They also increased retail market shares so that the BP-Mobil JV was able to compete on equal terms with Shell and Exxon.

This merger was followed by Shell and Texaco (plus Star,) merging in 1998 into two regional companies. Ultramar and Diamond Shamrock and Ashland and Marathon also effected U.S. downstream mergers. In the U.S. upstream, the Permian Basin assets of Shell and Amoco were merged to create 'Altura'.

"Mega Mergers": A New Era for the Petroleum Industry

These sectorial mergers, while in some cases successful in increasing profitability at the micro level, were insufficient to have a fundamental impact upon corporate level profitability and returns. Corporate transformation thus required a greater response.

The first corporate level move was the merger between British Petroleum and Amoco to create BP Amoco. This created a new "super major" approximately equal in size to Exxon and Royal Dutch Shell.

The merger had both a cost saving and strategic rationale. A cost reduction of $2 billion was realised.

In terms of strategic rationales, the merger solved many of the portfolio dilemmas of the two separate companies. For example, BP had for many years been aspiring to increase the size of its gas business. Amoco was the largest North American natural gas producer. Amoco had long been seeking a rebalancing of its portfolio with access to growth outside North America. BP provided the lead position in the UK North Sea.

The merger of the two medium large companies to make a large "super major" offered a further potential gain. Both companies had previously felt inhibited in holding large shares of material growth options. The new size of the company offered "reach". This implied both the ability to retain a large share of a growth option and the ability to chase a wider range of options at any one time.

The BP Amoco merger was followed by a series of other deals that have further transformed the structure of the petroleum industry. Most importantly Exxon and Mobil announced in December, 1998 their intention to merge. The rationale is again cost saving with the expectation that Exxon's corporate cost culture will rapidly squeeze costs out of Mobil's operations.

The French company Total also responded aggressively. First it announced its merging with Fina of Belgium. Total/Fina then launched a bid for French rival, Elf, which was eventually accepted by Elf. The joint group will become the fourth largest petroleum company in the world. Meanwhile,

(continued on page 12)

Changing World Petroleum Industry *(continued from page 11)*

Repsol of Spain acquired YPF of Argentina.

Low oil prices were not a primary driver of these mergers. The main objective was to enhance performance and profitability, whatever the external environment, and to create or access growth options. Low oil prices, nevertheless, increased the urgency to improve performance.

On 1 April 1999 BP Amoco announced its intention to acquire Arco (Atlantic Richfield). This potentially provides BP Amoco with a U.S. West Coast refining and marketing presence, an increased share of Alaskan exploration and production and a set of Asian natural gas assets.

New Drivers of Competitive Advantage

The Industry Has Changed

This set of deals will, if completed, establish a new petroleum industry structure. The rankings of companies in terms of market capitalisation, production and reserves has changed significantly. See Table 1. A new group of three super majors (Exxon-Mobil the largest, followed by BP Amoco (+Arco) and Royal Dutch Shell) are the largest companies with Total-Fina/Elf fourth in terms of market capitalisation.

Changing Industry Boundaries

The change to the industry structure has in fact been more profound. Previously, the private petroleum industry had been defined as it had existed in the 1980s and into the early 1990s. The boundaries were clearly defined. Competition from players outside the industry–namely those whose main business was not petroleum production, refining or marketing –was limited.

Table 1: Petroleum Company Market Capitalisations

(US$ billion)

1 January 1998		9 September 1999	
Shell	191.0	Exxon + Mobil*	280.3
Exxon	150.9	Shell	221.8
BP	75.8	BP Amoco + ARCO*	215.3
Mobil	56.6	Total FINA + Elf*	98.1
Chevron	50.6	Chevron	64.0
ENI	45.5	ENI	48.0
Amoco	41.5	Repsol + YPF	38.3
Elf	32.2	Texaco	37.2
Texaco	29.8	Conoco	18.1
Total	26.6	Philips	13.5
ARCO	25.7	Petrobras	13.3

Source: Datastream

* Assuming pending transactions completed

Other changes have taken place within the industry during the 1990s. These have had the effect of redefining the industry boundaries, structure and definition. The key forces of change have been:

- The ***disintegration*** of the industry at an operating level. Previously vertical integration had prevailed from the well head to burner tip or pump. Intermediate markets have now been established and deepened along the value chain. The net result has been that barriers to entry have fallen along all of the chain and new specialist entrants have emerged in most segments.
- ***Deregulation*** has had the effect of opening up previously closed sectors to competition. The boundary between the old petroleum industry and the new deregulated gas and power industries is now indistinct.

Table 2: Market Capitalisation of Selected Private Energy Companies

US$ billion as of 9 September, 1999.
Excludes State owned companies.

Rank	Company	Country of Head Office	Market Capitalisation
1	Exxon + Mobil	US	280.3
2	Royal Dutch/Shell	UK/Neth.	221.8
3	BP Amoco + ARCO	UK	215.3
4	Total FINA + Elf	France	98.1
5	Chevron	US	64.0
6	ENI	Italy	48.0
7	Schlumberger	US	38.5
8	Repsol + YPF	Spain	38.3
9	Texaco	US	37.2
10	Tokyo Electric Power	Japan	31.1
11	Enron	US	30.2
12	Korea Electric Power	S. Korea	25.3
13	BG	UK	24.6
14	Halliburton	US	22.4
15	Endesa	Spain	21.4
16	Duke Energy	US	21.0
17	Kansai Electric Power	Japan	19.1
18	Southern	US	18.4
19	Conoco	US	18.1
20	Chubu Electric Power	Japan	13.6
21	Phillips Petroleum	US	13.5
22	Petrobras	Brazil	13.3
23	Iberdrola	Spain	13.3
24	Norsk Hydro	Norway	12.1
25	CLP Holdings	Hong Kong	11.8
26	Baker Hughes	US	11.7
27	P G & E	US	11.5
28	Scottish Power	UK	11.1
29	Gas Natural	Spain	10.9
30	Texas Utilities	US	10.8
31	Centrica	UK	10.6
32	Unocal	US	10.3
33	USX-Marathon	US	10.3
34	National Grid	UK	9.8
35	Electricidada de Portugal	Portugal	9.8
36	Consolidated Edison	US	9.7
37	National Power	UK	8.9
38	Edison International	US	8.7
39	Dominion Resources	US	8.7
40	Public Service Enterprises	US	8.7
41	Occidental	US	8.3
42	Houston Industries	US	8.1
43	Peco Energy	US	7.8
44	Burlington Resources	US	7.8
45	Kyushu Electric	Japan	7.5
46	Powergen	UK	7.0
47	American Electric Power	US	6.9
48	United Utilities	UK	6.5

Source: Datastream

The net result is that the boundaries of the petroleum industry have now changed. The industry should now be considered to include:

- state companies such as Saudi Aramco, PDVSA, etc.
- new refiners such as Tosco and Valero
- hypermarkets (such as Tesco, Carrefour) who have at-

tained a substantial share of a gasoline market

- gas companies such as Enron who is a gas producer and transporter but is also a leading gas marketer and trader, power generator and power retailer and
- electric power companies such as Southern, Duke and PG & E who market gas as well as generating and distributing electricity.

The industry ranking including power companies, gas companies and service companies (see Table 2) now looks different from that shown in Table 1, even when state owned companies are excluded from the classification. The big fish have gotten bigger–but the pond is distinctly larger, too.

The "Super Major Theory"

Though there is no unique theory, the "Super Major Theory" has the commom theme that the super majors will be in a position to dominate the petroleum industry.

The European Commission was particularly concerned that in time the super majors and OPEC would control the E&P sector and thus be able to manipulate crude oil prices to a level which generates maximum rent for the incumbents (i.e., the OPEC states and the super majors).

BP Amoco argued strongly that this hypothesis was flawed. A number of factors were cited to support this argument:

1. The super majors do not have dominant access to technology, know-how and skilled labour.
2. Financial resources and strength do not reside uniquely in the super majors.
3. Resource owners–host governments–are very unlikely to permit a group of three companies to dominate development and production of their resources. Host governments regularly diversify their allocation of licences.
4. Small E&P companies have been successful in discovering and developing oil and gas in frontier regions.
5. Super majors are not and will not be in a position to control levels of oil production either now or in the future. In practice, control over both production and field abandonment is severely constrained by a number of factors:
   - The companies in a vast majority of cases do not operate under exclusive licenses–but rather as joint venture partnerships.
   - Companies are precluded from controlling production. The ultimate control of production levels lies with host governments.
6. The super majors may be the largest private petroleum companies by several measures. However, as Tables 3 and 4 show, their total share of world reserves or production is still small and well below any measure of dominant shares.

To be convincing, any version of the super major theory would require a number of conditions to hold:

1. The super majors' existing share of a relevant market must be high. As Tables 3 and 4 show this does not hold today
2. Host governments would need to permit the super majors to control production volumes and asset abandonment.These conditions do not hold today and cannot reasonably be expected to hold at any time in the future.

The competition authorities have shown greater and more specific concerns about competition in downstream oil markets. Undertakings as to divestment and other matters

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Table 3: World Oil Reserves

	Worldwide			Non-OPEC		
	Gas	**Oil**	**O&G**	**Gas**	**Oil**	**O&G**
	million cf	million barrels	million boe	million cf	million barrels	million boe
BP Amoco	32767	9317	14966	31740	7278	12750
Arco	9844	2842	4539	6844	2522	3702
BPA + Arco	42611	12159	19506	38584	9800	16452
Exxon	42294	6215	13507	42094	5865	13123
Mobil	15712	4738	7447	10512	4338	6150
Exxon/Mobil	58006	10953	20954	52606	10203	19273
Shell	60462	10031	20455	59882	8781	19105
Combined Companies	161079	33143	60915	151072	28784	54831
Worldwide	5170300	1052900	1944331			
Non OPEC				2963500	252400	763348
	% Worldwide Reserves			% non-OPEC Reserves		
BPA + Arco	0.8%	1.2%	1.0%	1.3%	3.9%	2.2%
Exxon/Mobil	1.1%	1.0%	1.1%	1.8%	4.0%	2.5%
Shell	1.2%	1.0%	1.1%	2.0%	3.5%	2.5%
Combined Companies	3.1%	3.1%	3.1%	5.1%	11.4%	7.2%

NB. Some OPEC reserves data for Arco, Exxon, Mobil and Shell are estimated.
Data Source: Annual Reports; BP Amoco Statistical Review of World Energy June 1999.

Table 4: World Oil Production

	Worldwide			Non-OPEC		
	Gas	**Oil**	**O&G**	**Gas**	**Oil**	**O&G**
	million cf/d	thousand b/d	thousand boe/d	million cf/d	thousand b/d	thousand boe/d
BP Amoco	5808	2049	3050	5481	1877	2822
Arco	2104	651	1014	1718	590	886
BPA + Arco	7912	2700	4064	7199	2467	3708
Exxon	6322	1567	2657	6322	1523	2613
Mobil	4295	935	1676	2875	603	1099
Exxon/Mobil	10617	2502	4333	9197	2126	3712
Shell	7862	2354	3710	7756	2019	3356
Combined Companies	26391	7556	12106	24152	6612	10776
Worldwide	219804	73105	111002			
Non OPEC				185911	42375	74429
		% Worldwide Reserves			% non-OPEC Reserves	
BPA + Arco	3.6%	3.7%	3.7%	3.9%	5.8%	5.0%
Exxon/Mobil	4.8%	3.4%	3.9%	4.9%	5.0%	5.0%
Shell	3.6%	3.2%	3.3%	4.2%	4.8%	4.5%
Combined Companies	12.0%	10.3%	10.9%	13.0%	15.6%	14.5%

Data Source: Annual Reports; BP Amoco Statistical Review of World Energy June 1999.

Changing World Petroleum Industry *(continued from page 13)*

have ensured that downstream markets remain competitive.

New Drivers of Competitive Advantage

The petroleum industry, as it had been known in the 1970s and 1980s, has now changed fundamentally. The players have changed. Existing players are consolidating; new players are entering. Previous endowments are eroding. There are no technological barriers to entry. Industry boundaries have shifted, widened and blurred. Some existing players are investing along the value chain into other sectors such as gas marketing and power that had previously been effectively closed to the petroleum industry. It was also argued, that while the new 'super majors' are consolidating to improve performance, partly through cost reduction, it is wrong to presume that their size will cause them to be dominant in the petroleum industry.

The petroleum sector looks set to operate in increasingly open and competitive markets. Three factors seem set to influence this. First, the process of deregulation looks set to continue. Second, host governments are progressively opening their natural resources to international investment. And finally, it can reasonably be expected that the competition authorities will strive to continue to ensure that competition prevails in all stages of the industry.

The structure of the industry will most likely be determined by the degree to which various players establish and apply sources of competitive advantage in open markets.

Where are the new sources of competitive advantage likely to reside? John Kay in his book, *Foundations of Corporate Success,* used a framework which identified four generic dimensions which can drive competitive advantage: strategic assets; reputation; technology; and corporate architecture. This framework can be applied to the petroleum industry:

Strategic Assets: In the petroleum industry of the next decade strategic assets can be expected to include:

- large, low cost oil fields
- large, low cost gas fields with low cost access to markets
- refineries that are advantaged by configuration, geography and costs
- significant retail market shares with low logistical costs and advantaged supply and a strong convenience offer
- ideal sites that integrate refining and petrochemicals

New strategic assets will be created and sustained through building on three characteristics: technology, reputation and architecture.

Technology: technological skills and applications can be expected to be a source of future competitive advantage in a number of dimensions:

- innovation in the application of technology. The best examples of this have been in the upstream sector, especially in deepwater and subsea applications.
- positioning for leadership in face of step changes in technology in areas such as new fuel specifications, renewables, low carbon technology, fuel cells and the hydrogen economy.
- application of IT to reduce operating costs, lead moves into e-commerce, nurture a learning culture and to help sculpt new corporate structures.

Reputation: Reputation will become an increasingly important factor:

- to be a preferred partner in the development of new resources and markets that are being opened to international investment

- to be seen by consumers, communities and governments as being environmentally sound and responsible in terms of operations and product quality
- to be seen as ethically sound by all stakeholders
- to develop a strong brand that can permit the leveraging of marketing operations

Architecture: the successful company will develop and apply a corporate architecture or structure that nurtures behaviours that generate competitive advantage. From today's standpoint such characteristics include low costs, openness, flexibility, learning orientation and empowerment. In the future, the characteristics may change: the key is to be strong in the skills that are scarce.

In short, competitive advantage can be expected to stem mostly from key competences. The era of change now seems well established in the petroleum industry. Change seems to be dominant. Change and openness coupled with new market entrants point to further changes in competitive advantage in coming years. The industrial battleground looks likely to be in terms of core competences with the struggle between the existing players, who build on strengths and combine low costs with flexibility, and new entrants with sector specific honed skills, aggression and dynamism.

Conclusions

The petroleum industry is now in a period of change. The seeds of change initially lay in the OPEC nationalisations of the 1970s. The pressures for change accelerated during the 1990s, driven by opening markets, deregulation and low prices and margins. The pressures manifested themselves in low industry profitability. Sectorial consolidation selectively improved profitability. 1998/9 then saw the emergence of the most dramatic period of consolidation and change for at least seventy years. Three new 'super majors' have emerged as the globally largest private industry players. As mergers are completed, the focus will be on the delivery of enhanced profitability, initially through cost reduction.

A new industry structure is emerging but further change is anticipated. New players with specialised skills are entering the industry. The industry boundaries have widened and blurred in face of deregulation of gas and power and the entry of state companies into internationally competitive markets. The super majors have the potential to improve profitability but will not have unique advantages that could allow them to dominate the industry. The new petroleum industry will be increasingly competitive. Existing strategic assets will provide some advantage to incumbents. However, longer term competitive advantage looks set to be driven predominantly by core competences. Skills, knowledge, flexibility and dynamism are likely to be even more important than absolute size or incumbency.■

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Energy Policy Since 1979: From Lawson to Mandelson

*By Dieter Helm**

I Introduction

Faced with the surpluses of cheap energy in the late 1990s, it is increasingly difficult to recall the very different energy context back in 1979, nor the policy mind-set that went with it. Those were the days when oil prices were assumed to be heading ever upwards to the $60 a barrel level, coal prices followed the steady rise in miners' costs, gas was a premium fuel, and uranium was regarded as sufficiently scarce to merit reprocessing.

It was not surprising that the 1970s were the high point of post-war energy policy activism. The Department of Energy had been set up in response to the first oil shock; the Plan for Coal, after Heath's government had been brought down, laid out a predict-and-provide investment in mines and coal power stations; the AGRs were planned to break the dependency on OPEC; and THORP and the fast-breeder programme suggested a long-run non-fossil-fuel future. In the meantime, the state developed North Sea oil through BNOC, and natural gas through British Gas.

Energy policy represented a response to the problems of the 1970s—security of supply, and rising prices—in the context in which the state was naturally regarded as the instrument for delivery of what markets could not. It did keep the lights on (except in early 1974, during the miners' action), and it did produce sufficient capacity. When meeting energy demand was the problem, energy policy proved able to supply.

Much of the energy infrastructure of the 1980s and 1990s was inherited from the 1970s. All the Magnox, and some of the AGRs, stem from this period, as do the coal mines, and almost all the coal-fired power stations. Indeed, when the very different economic circumstances of the 1980s—and, particularly the very sharp recession of 1980–82—emerged, Britain was awash with coal mines and power stations, and North Sea output repeatedly exceeded the expected production and reserves. Gas was to prove extremely plentiful too. Resources in the North Sea turned out to be endogenous to price and costs; far from declining, the numbers kept being revised upwards.

The surplus of capacity was coupled with the very opposite of expectations—the oil price collapsed in the 1980s, and stayed low until the end of the 1990s, except for the blip during the Gulf War. The future was one of excess supply, not demand, and the efficiency of existing plant, rather than investment, a central issue. Competition and private ownership turned out to be the policy imperatives, not monopoly and state ownership.

It is this potential to surprise, for events in the energy sector to turn out quite different from expectations, together with the long lives of assets, which create the special problems of the sector. The history of energy policy is one of shocks and surprises in the face of a succession of conventional wisdoms. That energy is, with labour, the primary input into economic activity, and the harnessing of fossil fuels has been the major factor in 20th century growth, simply magnifies—and politicises—the consequences of mistakes.

In this paper, I shall focus on the relationship between policy and the underlying economic fundamentals, as played out in the major shift in policy heralded by the 1979 election, and, in particular, by the arrival of Nigel Lawson at the Department of Energy in 1981. Although politicians have, in practice, little room for manoeuvre, Lawson recast the very rationale of energy policy, and the radicalism of this initiative can be seen in the gradual unfolding of the privatisation and competition programme across the whole of the sector in the two decades that followed. Although there was no masterplan or blueprint, the underlying philosophy did change policy, and, as a change in direction, the natural comparator is that of the 1945–51 Labour government and the creation of *national*, rather than local monopolies in the state sector. Indeed, Lawson's policy was almost the exact opposite—competition, not monopoly; private ownership, not nationalisation. Of course, not all of this is down to Lawson, and he did operate in a new political climate. However, it is noticeable that it took the Europeans a decade to catch on, and that the United States did not seriously embrace retail competition until the second half of the 1990s. Britain could easily have followed the German model. (Indeed, but for the Falklands War, Michael Foot could easily have become prime minister in 1983.)

Transitions—which are what Britain has witnessed since 1982—are both more complex and more interesting than end states. The energy market will never become fully competitive. There will always be elements of national monopoly and oligopoly, but the path has become detectable, and policy since 1982 has shown a remarkable consistency, despite the frequent wobbles, particularly over coal.

Transitions rarely end, but they can be blown off course. Shocks and surprises have a nasty habit of undermining investments, and political fashions change. Since Lawson's initiative, there have been three secretaries of state for energy (Peter Walker, Cecil Parkinson and John Wakeham), and three subsequent ministers (Tim Eggar, John Battle, and now Helen Liddell). The five secretaries of state for trade and industry since the energy department was abolished have all had major inputs too—Michael Heseltine over coal in 1992–93, Ian Lang over takeovers and restructuring, Margaret Beckett over regulatory reform, Peter Mandelson over coal and the policy context, and Stephen Byers over Pool reform. Of these, Mandelson's intervention captured in the White Paper has been the most significant, and is, I shall argue, the most confused, and could yet prove the most damaging.

The structure of the paper is as follows: section II, sets out a stylised version of Lawson's approach, to be followed through the transitory arrangements by an overview of the main milestones in its implementation: privatisation, the decline of coal, and the opening up of the electricity and gas markets (section III). Section IV looks at the ways in which the competitive approach has been modified and adjusted, eventually producing the Mandelson White Paper. Section V provides a critique of the new policy, and section VI looks forward more speculatively to what might emerge for policy in the 2000s and beyond.

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II Lawson's Market for Energy

When Lawson became Energy Secretary in 1981, the policy agenda was dominated by coal and the threat of a miners' strike. There had already been one climb-down in the face of pressure from the NUM, and Lawson's predecessor, David Howell, had been preoccupied by coal stocks, and the aftershocks in the oil market of the second OPEC price rise.

Lawson brought three main components to energy policy—a clear and simple set of beliefs, a gradualist approach to reform, and an activist approach to appointments. By the time he became Chancellor, he had rewritten energy policy, put two significant pieces of legislation on the statutes—the 1982 Oil and Gas (Enterprise) Act, and the 1983 Energy Act—and put in place a very different set of managers in the nationalised industries.

The fundamental tenet of Lawson's approach was a preference for markets over planning, which had its origins in the economic liberalism of Hayek and Friedman. Lawson saw the planning activities of the CEGB as fundamentally misguided, particularly the attempts to predict demand and supply. Incentives too, were inappropriate; failures of monopolists would extend through to investment. The CEGB was unlikely to build either the right amount of plant, or the right sort. Implied rather than stated in this approach was a rejection of state ownership. Prior to the 1983 election (and the Falklands War, which transformed the Conservatives' election prospects), the concept of privatisation was far from the conventional wisdom it became. However, it was obvious that state ownership was inconsistent with a market approach to investment appraisal and decision-making.

It was natural for Lawson to stress the role of markets rather than that of the state. Yet, his view was not anti-government; rather, he was concerned to sort out their respective roles. In one of the most important speeches on energy policy in the post-war period, in 1982, he set out the new position.

> *I do not see the government's task as being to try to plan the future shape of energy production and consumption. It is not even primarily to try to balance UK demand and supply for energy. Our task is rather to set a framework which will ensure that the market operates in the energy sector with a minimum of distortion and energy is produced and consumed efficiently.*

Most attention has subsequently been paid to what governments (and by implication, the CEGB) should stop doing. The more complex and difficult problem, of what the role of government and energy policy is in a private and more competitive energy market, was left largely unconsidered (at least in theory).

The speech was, of course, only a guide and an aspiration; in practice, the government remained very active—preoccupied by the miners and promoting nuclear energy. With cheap and abundant energy supplies (not least because of the impact on industrial demand of the 1980–82 recession), security of supply meant coal stocks and plant flexibility to beat the miners, not external shocks.

Yet, even the coal problem had its solution in the new approach to energy policy. Breaking the power of the NUM meant breaking the market power of the NCB and the CEGB. Only through a vertical chain of monopolies, with captive customers, could costs be passed through to final customers. It was a cost-plus regime which did not even require rate-of-return regulation. Where the full costs (including capital) were greater than industrial and domestic customers (and voters) were prepared to pay, the Treasury provided the implicit subsidies. Indeed, until the Byatt Committee began to address these issues, there was no proper asset value. (It was very much like the French government arrangements with EDF and GDF today.)

Breaking monopoly in the labour market, therefore, required breaking monopoly in the product market. The long-run answer to Arthur Scargill turned out to be restructuring, privatisation, and full wholesale and retail competition—a process which would take at least two decades.

III Implementation—the Transition to Competition

The first steps toward the market approach were, in retrospect, very timid. The 1980 Competition Act had opened up nationalised industries, and they were subsequently exposed to a series of MMC investigations. Lawson's two Acts went further. The 1982 Oil and Gas (Enterprise) Act put an end to British Gas's expansionist North Sea plans, particularly its oil-related activities, which were hired off into Enterprise Oil. Henceforward, British Gas would primarily be vertically integrated by contract rather than ownership. Its network was also to be opened to others. The 1983 Energy Act made two further important steps towards competition. The Area Boards would be compelled to buy privately generated power at published tariffs, and common carriage would be available for large users.

The 1983 Act had much in common with the European directives at the end of the 1990s, particularly as applied to France. The dominant incumbent, the CEGB, remained integrated, and it had a monopoly of information. The *right to access* meant very little without detailed access and pricing regulation. Similarly, the *right to sell* was only helpful if the prices (and ancillary terms) were appropriately set. As the subsequent evolution towards competition was to show, *regulation for competition* is a necessary condition for markets to flourish—a further role of the state which Lawson (understandably) neglected. Competition does not happen spontaneously—the property rights have to be designed and enforced.

The two Acts failed in their aim to promote competition. If it was to develop, more radical interventions were necessary. Unfortunately, the miners' strike intervened, and Mrs Thatcher's long-awaited political battle dominated the 1983–87 government. Peter Walker, whose economic philosophy had much more sympathy for national champions and monopoly, took over at the Department of Energy, and presented a more corporatist approach. With the CEGB, through careful planning, the miners were defeated. British Gas, which had centrally planned and developed the natural gas transmission and distribution network, was privatised as an integrated monopoly and presented to an army of 'Sids', each assured that there was no prospect of retail competition. Wider share ownership was easier where a relatively riskless monopoly was on offer.

It was left to Cecil Parkinson (with Lawson in support at the Treasury) to reinvigorate the market approach to energy through the privatisation of the electricity supply industry. The privatisation has been much criticised for its timid

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approach to competition in generation, but, at the time, major concern was focused on whether the splitting of the grid from generation would be consistent with security of supply. The politics heavily constrained the restructuring—within the plan to build a family of ten PWRs in obvious conflict with the economics of the market. The structure adopted was a fudge, which subsequently unwound—National Power was to be made big enough to be able to use its dominance to impose nuclear costs. As it subsequently transpired, Lord Marshall, Chairman of the CEGB, had been right: only by keeping the CEGB intact could a nuclear programme prosper—as the French were to demonstrate. Restructuring the CEGB spelt the end of the nuclear dream, which prospered only in France through the integrated EDF.

The radical new structure proved workable in the short run—primarily because an open compulsory pool was created, independent of the generators, and because most of the economics were embedded in Vesting contracts. These protected the miners until after the next election (and especially the UDM miners who had worked through the strike), and domestic customers' prices were capped through the back-to-back contracts between British Coal, the generators, the regional electricity companies (RECs), and the regulated final market.

In the medium term, *after* privatisation, the market would gradually be made more competitive: a transition of eight years (and two general elections) provided for the coal industry to face the market in 1993, gave medium-sized firms the option to choose suppliers in 1994, and allowed full retail competition in 1998. Although not envisaged in the transitionary plan, virtually all the rest of the sector would, eventually, also be privatised, from British Coal to Nuclear Electric and (probably) BNFL. In the end, only a rump Coal Authority and (probably) a residual nuclear authority will be left fully state-owned.

The transition inevitably threw up lots of surprises, many of which were extremely important to the participants, but which will be lost in the history. Three broad features did, however, emerge—the importance of regulation for competition, the powerful forces for reintegration, and the enduring politics of the energy sector.

Perhaps the most naïve feature of the arrangements and the regulators' approaches to the transition was the belief that competition and deregulation go together—that, as the market is liberalised, regulation could wither away. It had its origins in the Lawson market philosophy. Thus, regulatory supervision of the 1998 programme was notable primarily by its absence, as dominant supply businesses were left to develop the necessary IT infrastructure to enable rivals to take away their customers. It turned out to be an extremely expensive programme, delivered late, and the system's flaws were (mercifully) largely hidden from the public gaze by the fact that not many customers wanted to switch. The full costs—and the limited benefits from a demand-profiled system—will probably never be known, especially as the Pool reform will introduce a new raft of changes, disguising much of the redundancy and failures in the existing system. The very idea that 14 monopolies, without major IT experience, could be left to get on with designing and implementing major IT systems *separately*, when these all had to interact with the Pool is, in retrospect, one which no other country should try to emulate.

Regulation, too, did not wither in the generation sector of the market; rather, repeated conduct and structural interventions were required. A whole battery of activity followed privatisation, from inquiries, Pool price caps, divestments, Pool reform, and entry bans.

The second, related, feature of the transition has been the reintegration of the energy sector. Faced with downstream competition, the legally binding monopoly relationship between upstream sunk costs and customers has been broken. Vertical reintegration is a response to opening up the retail market—to hedge along the vertical chain and attempt to preserve a *de facto* monopoly, where a *de jure* one has been removed. The public-interest response might have been quite different; to encourage the growth and development of futures markets to spread the upstream sunk costs, dealing with the risk without allowing the creation of market power.

This was not to be, largely for political reasons. Ian Lang, who succeeded Michael Heseltine at the DTI, allowed ScottishPower to take over Manweb, and heralded in the great American takeover wave. He balked at the PowerGen and National Power acquisitions of Midlands Electricity and Southern Electric respectively, but largely because of the pressure from Redwood and Lamont on the right of the party. His successors, Margaret Becket and Peter Mandelson, let vertical integration through. This might not have mattered if generation and supply had been separated by an open, compulsory, Pool, as the MMC recognised in its reports on the PowerGen and National Power bids. However, the proposed new electricity trading arrangements (NETA) abandon the main features of the Pool, allowing bilateral contracting in a voluntary (and, therefore, probably pluralistic) fashion. We return to this point below.

The third feature has been the politics, and, in particular, those of coal. The original transition provided for the ending of the subsidy and protection of coal in 1993. Contracts would thereafter be market-driven. In practice, neither the Conservative nor Labour governments have been able to withstand the political pressures. Both have propped up the miners—in the Conservative case, by further explicit back-to-back contracts at higher prices and volumes than dictated by the market (hence encouraging excessive gas entry); in the case of Labour, as part of the complex politics of new versus old Labour. The latter led to the Mandelson White Paper, dealt with below in the next section.

Politics has also influenced regulation. The windfall tax opened the way for energy to augment the traditional income and expenditure tax bases. The utilities have subsequently found themselves financing social and environmental policies, and the proposed Climate Change Levy is the latest intervention. There is no evidence to suggest that energy will become less political, and, indeed, a central weakness of the Lawson approach has been to imagine that it could become a normal commodity activity, like the rest of British industry.

IV Mandelson's White Paper

Notwithstanding the numerous deviations from the transitionary path, it is remarkable how much of it survived the 1990s, and, in particular, the change of government. By the time of the 1997 general election, it was possible to imagine serious Labour politicians saying what Lawson had said 15 years earlier. It had become conventional wisdom.

The windfall tax lanced a (largely political) boil, which Labour had used to represent what they deemed to be wrong with Conservative Britain—'fat cats' and high profits, at the expense of social responsibility and 'proper' regulation. It was part of Labour coming to terms with its inheritance (rather like steel had been to the Conservatives in the early 1950s). John Battle, the new energy minister, rolled up his sleeves symbolically, and embraced the 1998 competition programme. It remained to announce 'a review' of regulation, which was, at the outset, anything but radical.

There were, however, differences between Labour and the Conservatives. Labour had a wider set of objectives, which incorporated social and environmental objectives. The DETR concluded its Kyoto round with a 12.5% reduction target for a basket of greenhouse gases, and the government additionally pledged a domestic CO_2 reduction target of 20% by 2010. The former looked, and looks, easy to achieve; the latter may be close to impossible. A 10% renewables target was set and the Treasury has adopted an industrial energy tax. The implication for energy of the new environmental policy was relatively obvious: coal had little future.

By adopting economic instruments, environmental policy could be grafted onto the market approach. The sector would adjust to the appropriate price/tax signals. Unfortunately, at this juncture, the coal crisis broke, in the run-up to the expiry of the 1993–98 special contracts that Heseltine had brokered.

From the outset, the coal crisis was political—a case study in the tensions between old and new Labour. The ministers responsible for trying to resolve the tensions were primarily those who needed friends on the left—Geoffrey Robinson and Peter Mandelson. They had to come up with a 'deal' which could meet the conflicting criteria—pro-market and pro-competition, pro-environment, and pro-miners.

The eventual 'deal' was a complex fudge which owed everything to short-term political interests. It was multi-faceted, and the connection between the components remains obscure. The generators bought more coal; PowerGen was allowed to vertically integrate with East Midlands (and National Power followed with Midlands Electricity's supply business); a moratorium on new gas entry was announced; Pool reform was endorsed; the generators agreed to divest plant; and the environmental policy embraced an energy rather than carbon tax (the Climate Change Levy).

Government officials strenuously deny that a 'coal deal' had been done, and the White Paper that emerged provided a 'spin' reconciling the contradictions. It claimed that the problems of coal were the product of the market being 'rigged' against it. Apparently, the Pool allowed generators to hold prices up, sucking in excessive (gas) entry, thereby displacing coal-fired plant, and forcing it to close early. Hence, the gas moratorium would provide a 'temporary' pause, while the Pool was reformed, and a level playing field created. The environmental side was squared by broadening the definition of sustainable development to include not just environmental matters, but social ones too. The new definition could be made to fit almost any policy, including supporting the coal industry. The resulting new energy policy would be one that promoted security of supply, diversity and sustainability, and that was consistent with promoting competition. It was a triumph of 'spin' over substance.

A cursory glance at the history of the 1990s shows that the core argument has little support. Coal was protected through *higher* prices as a direct result of the 1993–98 deal. Any monopoly pricing was readily transparent through the (compulsory) Pool. Prices could have been reduced by firm regulatory action to break market power, and by the government's acceptance of the consequences for coal. The 'excessive' gas entry directly contributed to the meeting of the previous set of CO_2 and SO_2 targets. Banning entry cannot be regarded as pro-competitive, even in the short run, and the facilitation of voluntary contracting can only make abuse of dominance harder to detect.

V The Consequences of Mandelson's White Paper

Far from clarifying the role of government in energy markets, Mandelson's White Paper leaves most of the key questions unanswered. These include: the future of licensing policy, the trading arrangements, the incorporation of environmental considerations, and the relationship between government and regulators.

The *policy position on licensing* in the White Paper is that, once the Pool has been reformed, the moratorium will be lifted. Thus, sometime in 2001, a return to the liberal approach will be permitted. There are many reasons why this is an unlikely scenario. The timetable for the Pool reforms may be much more drawn-out than currently anticipated. But, even if it were to be completed on time, it is far from clear that the government would permit the anticipated further dash for gas to materialise.

In addition to the desire to smooth out investment, there are other reasons for a more controlled approach. Security of supply and diversity will not necessarily be optimally provided by the current structure of the market unless excess supply turns out to be a permanent feature. Governments are not necessarily better at such judgments (as Lawson pointed out), but the very fact of intervention indicates that Labour will want to continue to have a handle on this policy instrument. The environmental impact might be dealt with by market instruments, but the choice of a broad energy tax base over carbon suggests that the first-best approach will not be taken, and a degree of regulation may be necessary. Indeed, the 10% renewables target is, in effect, a licensing policy, with government backing some technologies over others (and almost certainly discriminating against nuclear compared with other non-fossil fuels).

If a more active licensing policy is to be a permanent feature of energy policy, then there are a number of choices over design. It could, and, indeed, most likely will, be discretionary and driven by government. Licensing policy gives political leverage, and ministers may well come to enjoy the powers of patronage, especially if promoters of new projects strive to make them politically acceptable. However, such a policy, raises uncertainty, and, hence, the cost of capital. Furthermore, in the absence of any rigorously tested criteria, it is unlikely to produce the optimal capital stock.

There are alternatives, both institutional and in substance. The government need not administer an activist licensing policy—it could be left to an arm's-length body. This could be an Energy Agency, separate from the detailed regulatory activities of OFGEM. In substance, the policy could be given some hard content through measurements of security of supply, and environmental indicators. These would necessarily cover the system as a whole, and then

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consider the marginal impact of a proposed new power station.

Most attractively, and more consistent with the market approach, the licences could be auctioned, thus allowing a market for licences in place of free entry.[1] The auction could take a number of forms, from a pre-specification of technology through to an open auction, which could identify the cost of choosing a more expensive option to meet the licensing policy criteria.

Measurement would, however, require government to be much more precise about the market failures the policy was designed to solve. The confusion between security of supply and the derivative requirement of diversity (which is *one* means towards security) would need to be resolved, and the trade-off (and price) of different levels of emissions would need to be defined. There is little evidence that the institutions of government—the DTI and DETR—are likely to be enthusiastic about such clarity, an issue to which I return below.

The *reform of the Pool* was embraced by Mandelson, as a way of presenting the unpalatable fact of support for the coal industry. It gave the White Paper a pro-competitive spin. Pool reform was supported for a variety of reasons, some of which are spurious. At its heart, the White Paper needed to make a direct connection between the decline of coal, the exercise of market power, and the design of the Pool.

That connection centred on the core features of the Pool—marginal bid price determination, the lag between bidding and price determination, and the pricing of capacity and compulsion. It has been argued that the Pool mechanism makes it easier for generators to collude because it focuses price determination on the major generators' marginal plant, and facilitates confidence in oligopolistic collusive behaviour. Added to these pricing issues is the rigidity of Pool governance and the lack of institutional flexibility in rule changing.

Many of these criticisms are valid, but none entails the RETA proposals which have now been translated into the NETA programme. The system marginal price *is* the efficient price, and the pay-as-bid reform simply increases the number of 'guessers', creating an element of uncertainty, and, hence, 'noise' in the price. Similarly, the time lag between bidding and price determination can be shortened. Governance can also be changed. Yet, these three reforms are evolutionary, and can easily be accommodated in the existing Pool framework. There is nothing radical or particularly demanding about any of them.

Reforming the capacity payment regime is more difficult. There can be little doubt that the VOLL/LOLP regime fails to signal the needs for future investment, and that it can facilitate the abuse of market power. Yet, it does not follow that simple abolition will solve the investment problem. At present, entry is attractive because of the technical substitution—cheaper gas for more expensive coal and nuclear. The entrants are queuing up. But such a circumstance may not last, and a necessary condition for a well-functioning market is that it provides remuneration for the sunk capital costs of new investment. There is no evidence to suggest the RETA/NETA proposals meet this condition.

The final component of Pool reform—compulsion—is the most important. Compulsion enforces a standardisation of contract form in the Pool, and facilitates liquidity and transparency. It creates a marker for both contracts and futures. By contrast, voluntary arrangements encourage proliferation of contract forms, reduce liquidity and make the abuse of market power—particularly through vertical integration—harder to detect. It follows that, far from reducing market power, NETA may well increase it, and undermine the transfer of upstream sunk cost risk from customers to financial markets, which is the most important requirement of breaking the monopoly link through supply competition.

There is, however, little evidence that the RETA/NETA promoters have thought these issues through, and, indeed, the highly technical nature of the issues involved, combined with the vested interests of the main participants, have militated against a proper consideration of the public-interest issues raised. The programme has not even been subject to an analysis of the costs and benefits, save merely to assert that overpricing by generators is of the order of £1.5m per annum, and that this reduction justifies the costs. (The other option—simply reducing the prices through effective regulation—has not been considered in this calculation—even if in the unlikely event the £1.5m turns out to be correct.) If regulators could *know* the extent of overcharging, then it does not take NETA to solve the problem!

Mandelson's White Paper is concerned primarily with solving the coal problem, while maintaining some semblance of competition market credibility. It does not seriously engage with the central energy policy challenge since Lawson's speech—*the environment.* Coal is a highly polluting industry—mines produce methane, are energy-intensive and pollute underground water supply. Transporting coal is environmentally damaging, and burning it is a major cause of SO_2, NO_x and CO_2 emissions. Ash disposal and water extraction for cooling add to the environmental problems.

On the principle of 'polluter pays', endorsed by the government, coal should be a heavily taxed activity, and, on environmental grounds, the industry should be reduced as soon as practically possible. (On health and safety grounds, too, very large contributions of public funds are needed to deal with the damage done to miners—on a par with the BSE crisis costs.)

Thus, on ordinary economic and environmental grounds, the Mandelson White Paper is a retrograde step. But the contradiction with environmental policy is more pronounced when the 20% CO_2 emissions target is taken into account. Protecting coal has had two knock-on effects—the burden on the rest of the economy has gone up as the displacement of coal by gas has gone down; and the main policy instrument, the Climate Change Levy, has been given an energy rather than carbon base, to avoid taxing coal proportionally to the damage caused. A clearer example of the failure to achieve 'joined-up government' is harder to imagine.

There are other knock-on effects. The renewables policy will require greater regulatory intervention since the tax will not improve its relative position. The full benefits of prolonging the life of nuclear stations will not be reflected in prices. But perhaps the most serious impact will be to delay the full incorporation of environmental policy within the DTI's approach to energy policy.

[1] I first proposed this approach in 1992, in response to the first coal crisis.

If the main implication of the Mandelson White Paper is that the relationship between government and the market is a complex and multi-faceted one, it is important to sort out the *institutional framework* within which this is contextualised.

The Lawson model, as extended and developed by his Conservative successors, required an independent and technically directed regulator to deal with residual monopoly problems, and a diminished governmental function within the DTI. The Mandelson model, by contrast, requires both a bigger and more extensive regulatory body, and a much larger function within the DTI. Both are, not surprisingly, expanding in numbers and costs.

Mandelson's White Paper does not, however, trace through the implications for the design of institutions, nor the trade-off between them. Whereas the Lawson model requires only an OFGEM and a few officials, the Mandelson model requires a licensing dimension, a location for security of supply and diversity work, and an institutional interface with the DETR. Much more medium-term thinking is required.

It is far from clear that the DTI can, in its present form, meet these new Mandelson demands, nor that OFGEM should expand its role from regulation into policy. Its role in RETA/NETA is a good example of how it can overstretch its proper domain. The Energy Advisory Panel is a very part-time body, and it is unfunded. There are several options, and each has its merits and demerits. Some of the functions of the Department of Energy could be recreated in the DTI (as, in fact, they already are—for example, the longer-term nuclear review and environmental modelling). Another option is to create an Energy Agency, to sit alongside the Environment Agency (and, to a lesser extent, the Strategic Rail Authority). Broad sectoral bodies—for transport, communications, water and energy—may well be in the mechanisms for the more activist policy approaches of Labour. What, however, is clear, is that the Mandelson White Paper does not begin to address the implications of the intervention it has encouraged.

VI Conclusions: the Future of Energy Policy

The Lawson speech in 1982 heralded one of the most radical policy-driven transformations of the 20th century—to rank alongside the nationalisations of the immediate post-war years. The transition it started has by no means ended, and it probably never will, given that the underlying model—a competitive commodity market—is no more than an organising principle.

Since Lawson launched energy policy on this path, significant political obstacles have been confronted. The lasting impacts include the demise of coal and new nuclear build. For many, these were merely part of the painful transformation of the market and provided a series of temporary hitches along that path.

This simple and attractive interpretation is not borne out by the facts. The Lawson initiative has transformed energy policy, and it has become part of conventional wisdom. Yet, therein lies its danger. The most important facts about the period which will stand out to future historians are the (unexpected) collapse of oil prices and excess supply. The market philosophy had a very benign backdrop against which security of supply could not be tested. Furthermore, it will probably turn out to be the last period in which environmental policy was not the main driver.

The experience since Lawson's policy initiative has taught that, even when energy is cheap and abundant, politics will continue to play a key role. Energy is, next to labour, the main input into all economic activity. The 20th century's economic miracle is built upon the exploitation of fossil fuels; a fact which national income statistics fail to recognise. The political *agenda* has changed, and, hence, the form of political *concern* has altered too. Furthermore, the mechanisms of intervention are necessarily difficult when government no longer owns the main energy companies, and monopoly has been reduced.

It was, perhaps, too early to expect that redefinition to take place. Yet, whereas Lawson seized his opportunity to at least outline a new direction for policy, Mandelson's preoccupation with the miners prevented him from stamping any new vision on the sector. Indeed, in its main components—licensing, Pool reform, the environment and institutions—he has left behind a considerable muddle for his successors to sort out. In the case of Pool reform, the damage may be very considerable.

If Mandelson failed, his successors need not. If Mandelson's White Paper does not provide a coherent energy policy, then his successors could fill this gap. What is needed now is a serious and long-term review of the role of government in the energy sector, and a new vision of how this could be achieved. In any such review, the environment is likely to be the dominating feature.■

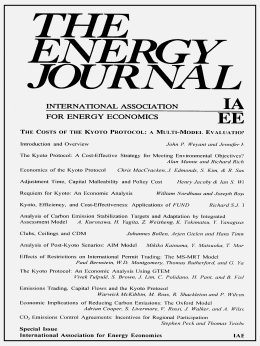
The Costs of the Kyoto Protocol: A Multi-Model Evaluation

Edited by John P. Weyant
(Energy Modeling Forum, Stanford University)

This Special Issues represents the first comprehensive report on a comparative set of modeling analyses of the economic and energy sector impacts of the Kyoto Protocol on climate change. Organized by the Stanford Energy Modeling Forum (EMF), the study identifies policy-relevant insights and analyses that are robust across a wide range of models, and provides explanations for differences in results from different models. In addition, high priority areas for future research are identified. The study produced a rich set of results. The 448-page volume consists of an introduction by John Weyant and a paper by each off the thirteen international modeling teams. More than forty authors provide richly illustrated descriptions and of what was done and concluded from the model runs that were undertaken.

Contents

ABOUT THE EDITOR: John P. Weyant is a professor of engineering-economic systems and Director of the Energy Modeling Forum (EMF) at Stanford University. His current research focuses on analysis of global climate change policy options and models for strategic planning.



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The Oil Future – A Very Different View

*By Roger W. Bentley**

At a recent BIEE two-day Academic Meeting in Oxford the opening speech was given by Lord Lawson, former UK Secretary of State for Energy, and subsequently Chancellor of the Exchequer. In his speech Lord Lawson dismissed the current predictions of oil shortage as scare-mongering. The meeting's closing summary appeared to go further, drawing on the work of Lynch and others to wonder if energy resource scarcity was itself a valid concept.

A group of us at the University of Reading hold a very different view. This letter explains why, and indicates how the use of public-domain data can illustrate the reasons for concern.

The key current prediction is that by the IEA, of a resource-limited decline in the production of non-OPEC oil in the near-term. We have looked at the underlying model and data for this prediction in some detail, and think that it is correct. If OPEC decide not to raise production significantly, as may be the case, the threat of oil shortage looks certain.

Lord Lawson argued strongly against such 'gloom & doom' forecasts, and Mike Lynch lent credence to this position by showing a wide collection of forecasts that had badly underestimated oil supply. What his work did not show, however, is how these forecasts were made. Some forecasts have been deliberately conservative, perhaps to predict minimum income streams, etc., while others almost certainly have extrapolated from proved rather than probable reserves.

A technique that does give good predictions of peak is that by Hubbert, where this predicts decline from the mid-point of the resource. Our appraisal of this model, both theoretically and in terms of its past performance, has shown it to be a good approximation. However, with public domain reserves generally low and unreliable, industry data are required; estimating the remaining resource base by adding yet-to-find (derived from the probable find history) to the probable reserves. Lynch, perhaps unintentionally, brought out this need for good data, quoting Campbell's 1991 prediction for the UK, but omitting to mention this was skewed by the use of the UK proved reserves of 4 Gb, rather than the probable reserves which were twice this.

Some analysts, understandably, are unhappy with a model for oil peaking that does not explicitly include price or technology. This view is reasonable, but has two answers.

The first is that price and technology are in the model, if only implicitly. The resource estimate includes all oil found to date, and thus includes that discovered during the years of high prices following the '73 shock. And the yet-to-find is based on the assumption that the price will be high enough to generate large numbers of new exploratory wells. From the point of view of technology, experience shows that once fields have seen secondary recovery, the *rate* at which oil recovered by tertiary techniques can be brought on-stream has little effect on peaking date.

The second answer supporting a simple model lies in the recognition that the main hindrance to accurate world oil modelling is the unreliability of the basic data, rather than the subtlety of the model. Poor data, for example, applies to the United States, bedevilled by reserves growth confusions; and to the FSU and the Middle East where the oil mostly lies, but where the data are especially problematic. Good modelling requires both a consistent data set, and calibration of the peaking point against the historical data.

Of course, if one is looking at a region where the data, including costs, are good, one would chose to make predictions of peak using the sort of detailed model reported by Professor Kemp for the UK. But even with this level of detail, the results show that while changing the variables significantly changes the shape of the decline, the *date* of UK peaking varies little as a function of the assumptions.

We can illustrate the different oil forecasting techniques by looking at the case of the UK.

Oil production forecasts for the UK, made between 1981 to 1993, have been quoted elsewhere by Lynch. The earlier of these were certainly on the conservative side, missing completely the major upturn in the early '90's. (Later forecasts also appear conservative, but this may yet have more to do with the timing of production, than the total production forecast.) At the BIEE meeting, the failure of these early forecasts seems to have convinced many analysts of the impossibility of forecasting oil production.

But how would a mid-point resources model have predicted production ? The UK government's 'Brown Book' contains contemporary estimates of the total original oil resource, and if probable estimates are used, at no point over the period would a mid-point calculation have shown a resource-limited peak to be at hand. For example, in 1986 which looked as if it might be peak, the probable resource stood at 29 Gb, while cumulative production was 7 Gb. On this basis, not only was 1986 clearly not the peak, but the mid-point argument would have indicated that peak would not come until nearly the year 2000. Today, with the Brown Book mean resource estimate at 38 Gb and cumulative production at 17 Gb, the peak looks imminent.

For countries that have gone over peak the general validity of the mid-point approach can be demonstrated by simply plotting their production histories. The classic 'single-peak' countries to look at are Austria, Germany, Trinidad, and, of course, the United States. The plot of the latter indicates that the United States has now burnt about three-quarters of its conventional oil, underlining the seriousness of the problem.

For more complicated 'multi-peak' countries, a history of when the major fields were found is needed. With this available, it becomes clear that groups of oil finds lead to later oil peaks. Indeed, it is this fact that the bulk of the oil is always found well before peak that makes predicting the peak largely deterministic. For example, the bulk of U.S. oil was found by 1930, with peak not occurring until 1971; while in the UK the majority of the oil was found before production even started.

Conversations at the BIEE showed that most analysts understand that the UK is a mature province, where peak is not far off, and where higher price and better technology will undoubtedly help the decline, but cannot shift the peak date by much. What is missing, at least with these analysts, seems to be an appreciation that *most of the world is just like the UK*,

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* Roger W. Bentley is Senior Research Fellow, Department of Cybernetics, The University of Reading, Reading, England. Roger Booth, John Burton, Bruce Sellwood and George Whitfield, all of the University of Reading also contributed to this article.

The Oil Future–A Different View *(continued from page 23)*

mature places where peaking is not far off. One has to talk to the geologists to understand that most of the world has now been explored, and most of the, at least medium-term, oil already identified. And while no one is going to defend the Hubbert technique as absolutely precise, in terms of predicting the future from the information to hand, it is an immensely powerful tool. Without it, one wanders blindly in a country inhabited by those for whom R/P ratios, and the view that it is all 'too difficult to model', are the only perspectives.

Now let us turn to the IEA's specific prediction: that non-OPEC output is close to decline.

Here again we can start with the presentation by Lynch. This included the observation, originally by Mitchell, that oil output from the 'Rest of the World' (RoW), i.e., the world excluding OPEC, the United States and the FSU, has risen steadily for many years. This is certainly correct; RoW output has grown from about 10% of world output at the first oil shock to about 40% today. Lynch's implication, however, is that RoW output will continue to grow for a long time to come.

Once again the answer can be illustrated with simple production data, for example from the BP-Amoco *Statistical Review* diskette. Production data, since 1965, should be plotted by country or group on an 'area' graph, plotting vertically up the page: United States, Canada, China, Mexico, UK, Norway, other RoW, FSU, OPEC outside Middle-East, and OPEC Middle East. It helps to use thick lines to visually group: USA + Canada, RoW, FSU, and OPEC.

The growth in RoW output, mentioned above, at once becomes apparent. And one is then in a position to enter predictions for future trends in the world's oil sources and sinks. The USGS confirms that the U.S.'s downward trend will continue; Professor Kemp (or UKOOA, or the DTI) can be asked about the UK trend, the NPD about Norway, and Pemex about Mexico; while China is already an increasing sink. This exercise, of course, does not *prove* that the whole of non-OPEC will soon go over peak, which depends on detailed modelling, including the FSU, but does give a picture of why this should be the case.

Finally then, we come to our views about the implications of all this.

Lord Lawson defended the philosophy that energy should be treated as a commodity. It is true that these days most analysts would support policies that remove the dead hand of government, and allow industry to show its initiative. Everyone also now recognises that there are many other sources of energy out there. The problems, therefore, as we see them, are two-fold:

- In the main, these other energies are more expensive than to-day's oil or gas, and some at least can only come to market rather slowly. Thus, as conventional oil gets scarce, and gas prices rise in sympathy, the old evils of world inflation and recession will re-appear. The effect on oil-poor developing countries will be especially severe.
- Markets do, of course, respond to signals, but oil and gas supply two-thirds of our energy; energy markets are price-volatile, and the time lags for significant structural changes are long.

As we adjust to the new realities, it looks like a very bumpy ride.■

A Debate on Global Warming Science with a Startling Conclusion on the Kyoto Protocol

*By Gerald T. Westbrook**

Although this meeting was held a year ago its subject and conclusions are still most timely. This debate[1,2] brought together seven, internationally renowned, global warming scientists and one prominent science and global warming writer, Dr. Richard Kerr of Science magazine, to discuss the science behind global warming. This group was fairly split between skeptics, neutrals and proponents as noted in Table 1.

Table 1

Scientists at the Houston Forum Global Warming Debate

Name	Affiliation and some comments
Proponents	
Dr. James Hurrell	National Center for Atmospheric Research, Boulder.
Dr. Jeffrey Kiehl	National Center for Atmospheric Research, Boulder.
Dr. Stephen Schneider	Professor, Environmental Biology and Global Change at Stanford University and a ubiquitous supporter.
Neutral	
Dr. Gerald North	Distinguished Professor of Meteorology and Oceanography; Head, Department of Meteorology Climate Research Project at Texas A & M.
Skeptics	
Dr. John Christy	U. of Alabama, Huntsville - Earth System Science lab. Key scientist for Satellite data base at NASA.
Dr. David Legates	Associate Professor, Southern Regional Climate Center, Louisiana State University.
Dr. Richard Lindzen	Alfred P. Sloan Professor, Massachusetts Institute of Technology and a pre-eminent opponent.

What follows are some highlights on the overall tone of the meeting. It was rather difficult for each scientist to make a concise and lucid presentation in the brief time available. What was achieved, however, was to see all of these individuals *in action* and to observe that a deep and complex debate on global warming exists. In the past the existence of a debate has been down-played, and skeptics have been depicted as few in number, negative, on the marginal side of the science and even a bit crazy. In contrast the skeptics came across as positive, brilliant, human and interesting. For example Dr. Richard Lindzen, of MIT, possibly the leading academician in the climate field and perhaps the world's most pronounced global warming skeptic, also teaches a course on American musical comedy. And Dr. John Christy, NASA and the University of Alabama at Huntsville, and one of the key driving forces behind the satellite based temperature data, is also a minister, a missionary in Kenya and a marathon runner. Dr Christy assured the students present that the

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* Gerald T. Westbrook is president of TSBV Consultants. Prior to his retirement from Dow Hydrocarbons & Resources Inc. in 1994, Westbrook was Manager of Market Intelligence and also served as the Hydrocarbons and Energy Economist for this company. He is also a Senior Associate at the CBA Energy Institute at the University of Houston.

current generation of climate scientists "will leave you lots of interesting problems to solve".

Although this meeting had separate segments on the measurement of temperature and on anthropogenic versus natural climate change, the audience might not have picked up that the global warming debate really centers on these two rather simple jobs – at least simple in concept. These tasks, namely the detection of a warming and an attribution of what is the source of that warming, need to be repeated over and over again along with the relative status of each task.

Temperature and Other Weather Data

Christy effectively defended the satellite based temperature record over the past ~20 years. Several adjustments have been identified. Media reports often seem to be presented in a fashion to convey that these corrections finally resolve major differences with surface based data, and as a result, we are left with the conventional wisdom that the world is warming. However, Christy was confident that the basic and major differences in temperature trends remain. These show the satellite data with a slightly negative temperature trend versus a positive trend for surface based data. This conclusion, he argues, is also supported by balloon data and a third source ... night marine air temperatures.

Christy also expressed concern on the recent flurry of reports on so-called extreme climate events as evidence of global warming. He noted that extreme weather events occur somewhere all of the time. This is a perfect situation for a politician who wants to get a photo op of his concern and involvement in this issue. As an example of this kind of hype, he cited the reports on the extreme drought in Texas this summer of 1998. He noted while Texas was very hot and dry this summer, the worst period by far was the 1930s. In that multi-year period drought existed all the way from Canada down to Mexico. He noted, in contrast, how Kansas this year has had bumper crops. In short the Texas summer of 1998 was entirely within the band of natural climate variation.

Christy concluded that climate is changing. It always has and always will. While a fraction of that change may seem to be coupled to human activities, no one knows how much.

Anthropogenic vs Natural Climate Change – the Signal-to-Noise Ratio

The problem of noise in the data and in the overall communications on this subject was noted. Dr. Lindzen commented that most of what the public knows about global warming does not come from the scientific community, but rather from advocacy groups such as the Union of Concerned Scientists, the Sierra Club and so on. And some people from such groups distort things.

Dr. Gerald North, from Texas A&M, noted that there are traps and minefields all over the detection endeavor and also political pressures in doing research on this subject. He felt that long-term climate simulations can help to understand the noise in the system. He introduced the radio analogy where you have a signal and lots of static. And that is what we have with climate research. He noted you are looking for very faint signals in a very noisy system. North commented on several climate signals as follows:

- he argued that the solar signal is not yet detectable,
- he noted that the volcanic signal is easily detected and
- he felt that the greenhouse gas and aerosol signals are detected, but each are large and are near canceling each other out so that their estimates are likely inaccurate.

He asked: "Is this status enough for use on policy analysis questions?" He answered his own question with a, "not sure ... maybe can do some things".

Lindzen noted that we are talking of very very small temperature changes. He suggested that natural climate variability needs a great deal more emphasis. He discussed four areas of natural climate variability that the large computer models do not pick up at all, or do so with insufficient details or accuracy. The El Niño is the best known example of such natural climate variability.

He reported a problem today with the testing of the large computer models of the climate. He sees a circular trap. Today we use estimates of the natural climate variability, obtained from very long term runs of a model, to test the model. He argues this approach is "on pretty shaky grounds". Lindzen also noted that the aerosol forcing may be uncertain by as much as a factor of ten.

Conclusions

The seven scientists were asked at the end of the session if they could, *would they sign the Kyoto treaty? Six of the seven scientists said no.* Dr. Stephen Schneider voted yes as did the science writer, Richard Kerr. Gerald North voted no, a change from his prior position. This change was based on a recent paper[3] by Tom Wigley, National Center for Atmospheric Research, and a noted proponent in his own right. Wigley's conclusions from his latest model runs found the Kyoto protocol, if fully implemented by all involved nations by 2010 (an event that would be extremely unlikely), *would reduce warming 0.07 ºC by 2050 and 0.2 ºC by 2100.* In short *the influence of this protocol would be undetectable for many decades.* Dr North indicated that "six months ago I would have signed". "Now, I would not put the world through all the discomfort" for such a tiny savings.

Of the several questions fielded two were of particular interest to this observer. The question was raised as to where did the money come from to conduct this research. The panelists answered, randomly, with names like EPA, DOD, NOAA and finally NASA. I kept waiting to hear the words *the American tax-payer*, but they never came. The second question was from a student seeking guidance on what his generation should do in planning for the future. Dr. Christy suggested you need to learn how to think, and also to find out why other people think the way they do. You need to ask yourself where is the data they are using coming from and what kind of agendas may be behind those sources.

Let me build on this a bit by expanding on the radio analogy, the *signal-to-noise ratio* noted earlier. Students, indeed all of us, are besieged with thousands of messages every day from TV programs, movies, video tapes, radio, TV ads, tele-marketers, newspapers, magazines, the Internet, political pitches, political spin, peers, peer groups and so on. This writer wrote a paper about 15 years ago on what was termed the emerging communications revolution. While correct on the issue and direction, the incredible magnitude of this revolution was totally missed as the traffic volume anticipated has been totally eclipsed. Further the issue of message quality wasn't even discussed. We are living in a world today of very low signal to noise ratio. Hence students,

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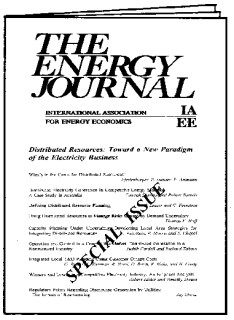

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The Cost of Kyoto: How Can Industry Thrive in a Post-Kyoto Environment?

*By Jean-Marie Bourdaire**

It is a pleasure to be with you in Rome thanks to the IAEE and to look, together with you, at the energy and carbon trends. Will they be as flat as the Kansas horizon as Amory Lovins put it for electricity in 1984?

We, in the IEA, do not believe in such a flat perspective. Our 1998 WEO and, the challenging paper on climate change that our executive director delivered last month to the IEA Energy Ministers at our 25th Anniversary celebration, provide the vision of a strong and regular increase of both energy and energy-related carbon emissions in a business-as-usual scenario. As you can see, our new approach is based on the notion of energy-related services: inputs in power generation, electricity demand, transport and stationary fossil fuel end uses in relation to the GDP.

So far, the only factor which evidently influences the past aggregated trends is that of prices: end-user price changes have resulted in a break of linear trends and, conversely, trends have remained constant as long as end user prices have not changed. Furthermore, comparisons among countries or regions reveal a clear inverse link between the slope of a trend, i.e., the energy intensity of GDP, and the end user price. These remarks apply either to final electricity demand, to the stationary fossil fuel end uses or to transportation trends. We believe that, unless significant price changes happen for end-users, these trends will continue unabated in the future. Whether this will be true also for energy supply is uncertain, but we are a little bit more optimistic because we expect that the overall thermal efficiency of power plants will increase thanks to technology (in particular in CCGT), competition (brought by deregulation) and a better use of the lost heat (e.g., with commercial and residential co- or tri-generation units).

Overall, given that energy accounts for 85 percent of all greenhouse gas emissions in developed countries, this highlights the size of the Kyoto challenge for the energy sector.

At this stage, let me share quickly with you a few thoughts on energy-related carbon trends. Their past rigidity highlights the challenge we collectively face to abate them.

To make a long story short, given the rise of the trends, Kyoto commitments come as an enormous challenge. It is in this context that I wish to address the topic of the practical implementation of the Kyoto protocol, and how industry can survive in an after-Kyoto context.

Today, most of the details of domestic policies and measures as well as the precise aspects of the elaboration of the flexibility mechanisms are not known. So, let me be simple and blunt in summarising my views in three words "certainty, fairness and cost-effectiveness".

Certainty, because both the deregulation process and the challenge brought by Kyoto are creating enormous uncertainties which prevent industry from moving and investing as fast as it could, thus lowering their contribution to economic growth. Uncertainty has a cost because decisions made in such a context imply high hurdle rates and myopic investment decisions. A clear step-by-step timetable, well-defined tools and objectives and strong institutions will contribute to create more "certainty".

Fairness is also very important because the competitiveness of the individual industrial actors is at stake if the burden of the commitments is not equally shared either among the national or the international competitors. Fairness is a two-sided coin with on one side the imposed emission target and, on the other side, the marginal value of this constraint.

This in turn leads us to a last aspect, that of cost-effectiveness. For industrial actors, the concern is not that of the overall national cost-effectiveness. They know that policy constraints will impose compromises such as a certain amount of domestic policies and measures, the choice of regulatory instruments in preference to economic instruments because of public acceptance, or a burden sharing across sectors and energy services which is not necessarily consistent with an unique marginal "carbon value". Hence, policy compromises will rather lower their pain.

Individual industrial actors need the insurance that the marginal cost will not skyrocket because of a lack of flexibility and the insurance that the government take, be it taxes, tradeable permits or the cost of regulations will be recirculated in the economy. This is the reason why industry backs the flexibility mechanisms. They lower the cost and spread the benefits on non IEA countries.

After this global overview, let me try to be more specific. In terms of economic instruments, only few options are available to engage industry on the road towards meeting the Kyoto goals. As I have mentioned, raising energy prices would be one option; the other, equivalent in economic terms is to apply tradeable caps to industrial emission sources. Many countries are considering this latter option, sometimes in combination with taxes: Canada, Denmark, New Zealand, Norway, the United Kingdom, the United States, to name a few. Denmark has already introduced a tradeable quota system onto its power producers, starting in 2000. Private companies such as BP-Amoco and Royal-Dutch-Shell are also applying tradeable permits to reduce their corporate CO_2 emissions. As a market instrument, trading seems to win the favour of industry.

As you all know, carbon taxes cannot be designed to meet emission objectives with full certainty. And tradeable quotas face their own problem: the uncertainty on the marginal cost of reductions, even if one knows that it is minimised by the system. If tradeable quotas are to be the instrument of choice for climate change policy in the industry sector, two practical questions are, therefore, worth asking: what system could remove the uncertainty on quota prices? And what system could avoid distortion of competition among industry actors covered by different systems?

There is one answer to the first question, and that is to cap the price of quotas with a penalty: companies could either meet their emission objective, or emit above that level and pay the penalty. No company should be ready to pay a price that is higher than the penalty. Of course, this principle only works if paying the penalty would cancel the extra-emissions. This is, in my view, the important point: penalty should act as a compliance incentive and not as another constraint.

(continued on page 29)

* Jean-Marie Bourdaire is Director, Long-Term Co-operation and Policy Analysis, the International Energy Agency. This is an edited version of his talk at the 22nd annual IAEE international meeting, June 9-12, Rome, Italy.

Summing up the BIEE 1999 Conference on: *A New Era for Energy? Price Signals, Industry Structure and Environment*

St John's College Oxford, September 20/21 1999
(Sponsored by BP Amoco, DTI, National Grid and OXERA)

This was the third BIEE conference in 'academic' vein and was a resounding success, with attendance of over 140. The Oxford setting was ideal, and compared to the previous two BIEE conferences held at Warwick, debate was sharper and sometimes had more political edge.

But the wider intellectual agenda was also different, and not just because the conference title had changed. The main reason for this changed agenda was that in the period of almost two years since the previous conference, world energy issues have moved on in at least two important ways:

- Mergers and takeovers have become a much more prominent feature of the world's energy industries, and companies in oil and gas as well as electric utilities are rapidly becoming much larger than ever before. Traditional issues about the effectiveness of competition, and the regulation of market power have assumed renewed importance;
- Environmental regulation has at last become a serious issue for many governments and energy companies. The environment has steadily moved up the international policy agenda since the late 1970s but only in late 1997 was the Kyoto Protocol agreed, carrying with it for the first time the prospect of legally binding commitments to reductions in carbon dioxide emissions. Some large energy companies now take serious account of environmental issues in their own planning, either defensively or (increasingly) as market opportunities.

It is always useful to start from first principles–for economists, Adam Smith. Smith's contribution was much wider than to analyse so brilliantly the advantages of markets and the division of labour: he was also deeply worried by the tendency of unregulated capitalism to lead to cartels and monopoly, and was a powerful advocate of the enforcement of market rules by public agents. The unhampered pursuit of profit, far from automatically leading to vigorous competition, often leads to high concentrations of market power, at least in those (common) situations where there are no diminishing returns to size or scale. So while *competitive* markets are necessary and desirable, we should not confuse them with *free* markets.

This is especially relevant for energy businesses, where company size is often large and political interest is intense for a variety of reasons. Politics cannot be abolished from energy markets, and economic analysis that simply complains of the 'irrationality' of politics is unlikely to help much. As Smith would have put it, we need political economy as much as economics.

The three themes of the conference were energy prices or signals, market structures and the environment. In slightly (but not wholly) facetious vein, and simplifying grossly, the following classification of the approach of the conference papers seems to make sense:

- in the case of prices, the dominant discipline is economics, the subject of study is markets, the preferred policy prescription is deregulation, and there was, in the conference papers, a general air of approval;
- for market structure, the dominant discipline is political economy, the subject is the interaction between markets and policy, and the policy prescription is *re*-regulation. The general tone was one of regrettable necessity;
- for environment, the discipline is political science, the subject is politics and the policy prescription is simply regulation.

In the environment case this was something of a surprise. Few papers were framed in terms of environmental economics, and when the environment came up, it mostly appeared not as a subject of analysis but rather as, at best, a constraint and, at worst, a serious nuisance. This suggests that the vast amount of recent years' work on environmental economics is yet to be taken seriously be many energy economists: the environment is seen as important politically and probably ethically, but not economically.

The linked issues of market structure, takeovers, integration and competition were intellectually dominant at the conference, and provoked much debate. Small may be beautiful, it seemed, but big may be necessary. But the idea of 'bigness' needs disaggregating. In the energy world, the dominant concept has historically been the engineering economics idea of economies of scale, where scale referred to the size of individual production units (turbine generators, oil platforms). It is now widely agreed that we are free from the tyranny of these economies of scale and smaller scale technology can compete profitably against large.

However a second kind of bigness remains vital–the economies of mass production. These have definitely *not* become redundant, and one of the main hopes for the new small-scale technologies like renewables is that the numbers of units needed (often hundreds or even thousands) will allow economies of mass production to work more effectively than for the older larger-scale technologies where batch production was the best that could be managed.

There was of course a third kind of 'bigness', directly connected to market structure–company size. If technologies were getting smaller in scale, and if being a small firm allowed flexible and rapid responses, why did companies keep getting larger and more integrated, horizontally and vertically?

Debate sometimes confused two quite distinct but often conflated ideas: competition and competitiveness. Competition is a property of a market system as a whole, and it is difficult to see many situations where greater concentration and integration lead to higher degrees of competition systemically. Competitive*ness*, on the other hand, is a property of the individual firm, and firms often feel that getting bigger will help them become more competitive, or successful in the market. But whether this leads to more *competition* is doubtful, though ironically much of the recent frenetic merger activity has been a defensive response to markets becoming more competitive in formal structure (for instance, the European electricity market). Several papers at the conference, from orthodox and more radical perspectives, raised serious questions about integration and increased degrees of market power: others made a spirited defence, from a market competition perspective, of the new larger companies.

Technology also featured in many more papers than at Warwick. The apparent contradiction between smaller scale technologies and larger companies was remarked above. But other papers also stressed technology in a variety of contexts: cutting costs in the North Sea oil business; responding to climate change imperatives; forecasting energy demand; and in the impact of liberalising electricity markets. All this reflected a concern with longer-term allocation issues, rather than the details of immediate re-structuring which had absorbed attention at earlier conferences.

Two last issues can be mentioned briefly. First, a number of papers seemed to sound the death-knell for the economic theory of depletion, which (crudely) argues that when natural resources are fixed, their price will rise at the real rate if interest as depletion proceeds. What the conference papers attacked was not the logic of this position but its assumptions: a mixture of technical progress in extraction and a constant stream of new resource discoveries appeared to be holding the depletion effect at bay indefinitely.

Finally, the biggest intellectual challenge of all was to find ways of reconciling the two great agendas affecting the world's energy industries: liberalisation and environmental protection. Pursued separately, these two agendas could easily prove contradictory (liberalisation encourages fossil fuels over hydro and nuclear: action against climate change is pre-disposed against fossil fuels). Several papers bravely tried to show these two agendas might be reconciled, and the challenge now is to take such analysis much further. This could just prove to be the theme of the next BIEE academic conference.■

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Global Warming Debate *(continued from page 25)*

indeed all of us, to become effective, need to function like *World War II radio operators striving to filter valuable intelligence out of the static and daily propaganda flood.* They need to learn how to process this huge data flow, assess it, deflect most of it, filter out some of the noise, store it in their back brain cells, retrieve it as needed, and compare it to new inputs from new sources as these occur. Without this capability individuals will become easy marks for the commercial, environmental, educational and political shysters that are endemic in our society.■

Notes and References

[1] The seminar was held on 9-25-98 and sponsored by The Houston Forum, with program support from The Gordon and Mary Cain Foundation. This event drew an eclectic and heterogeneous audience of about 300, including 40 to 50 high school students and their teachers.

[2] Westbrook, Gerald T., "Global Warming Forum on Science Behind the World's Hottest Environmental Issue," *eco•logic*, Number 46, Spring 1999.

[3] Wigley, T., *The Kyoto Protocol: CO_2, CH_4, and climate implications*, Geophysical Research Letters, 25, 2285-2288, July 1 1998.

The Cost of Kyoto *(continued from page 27)*

What could be an acceptable penalty level? Denmark is using 6 dollars per tonne of CO_2, that is, about 22 dollars per tonne of carbon. An IEA study on the impact of a 100-dollar carbon tax on energy-intensive industry shows the overall impact to be moderate, with variations across countries and industry, of course. Hence a "penalty" of say 20 dollars per tonne of carbon, the value chosen by the World Bank for their backcasting study and for their "carbon fund", would probably not have disruptive effects on industry and yet be effective given that, for instance, such a level is sufficient to make nuclear competitive against coal on average in IEA countries.

Finally, industries are also much concerned about their total as well as marginal cost of reductions versus the cost applied to their competitors. This has led some parties to the Climate Change Convention to call for applying the same allocation rules for emission trading across countries and industry. For instance, governments could all decide to grand-father emissions to industry, that is to distribute permits for free or to systematically auction them … Surely, there will be pressure by industry for grandfathered emissions, but I want to point out the fact that this is only the beginning of a discussion that aims to assure that the constraint on greenhouse gas emissions will not introduce blatant distortions in international competition.

To conclude, let me reiterate the obvious: for the energy industry, the Kyoto target is an immediate issue, given both the leadtime and lifetime of investments in the sector. It is also clear that the energy industry is likely to face considerable costs to meet these targets. In order to help industry move fast on this issue, governments need to deliver clear signals. I personally believe that a combination of tradeable quotas and a price signal, i.e., a modest penalty for non-compliance, may be best way forward. No doubt, governments and industry face an immense task to implement such a system, but they should realise that alternatives are few if they wish to address climate change seriously.■

Note: IEA Executive Director's paper on "Energy and Climate Change: the Challenge" can be obtained at http://www.iea.org/new/minist.htm

German Price Wars Cut Into Profits

*By Fereidoon P. Sioshansi**

As ***The Economist*** so accurately observed in its 28 August issue, "Germans are often wary of change. When they embrace it or have it forced on them, however, they do not go in for half-measures." Now that the German power industry has finally accepted that competition in the electric power supply is real and is here to stay, the industry has gone on a rampage unparalleled by anything seen elsewhere. The signs of this are noticeable on a massive scale on several fronts:

- **Consolidation**. The highly fragmented German electric power sector is thinking and breathing mergers and consolidation. Surprisingly, it is not just the small guys who are thinking of getting bigger merely to survive, but the very big who are trying to become gigantic on a global scale.
- **Price cuts**. What initially started as a bonanza for large industrial customers has now been extended to even the smallest of customers on a national scale.
- **Open war**. There are no sacred cows, no service area boundaries and no limits to what goes. It is open warfare, hand to hand, house to house, nationwide.

First, on the consolidation front. The long-rumored talks between Veba AG of Dusseldorf (a giant conglomerate that owns PreussenElektra, the number 2 German generator) and Munich-based Viag AG (another giant conglomerate, which owns Bayernwerk, the number 3 generator) were rapidly progressing in September. If all goes according to plan, the new company will be bigger than the archrival RWE Energie AG, based in Essen, in terms of generation (see Table). Moreover, the combined company will become the third largest power generator in Europe, after state-owned Electricity de France and ENEL of Italy—which, ironically, is being cut into pieces to be auctioned off in stages to private investors.

Who Is The Biggest Of Them All?

Top German generation companies ranked by sales, in TWhs

Company	Sales
RWE Energie	138
PreussenElektra	106
Bayernwerk	73
EnBW	51
Veag	47
VEW Energie	35
HEW	17
Neckarwerke	14
Bewag	13

Source: VDEW

Second, on the price cuts. It started with the large industrial customers. The German market was officially opened to competition in April 1998—well ahead of the European Union Directive, which opened 25% of the market this February. Since then, large customers have been swamped by a deluge of price cuts and extra sweet offers from competing generators on every corner.

Price cuts of 10-20% are the norm; 30-35% savings are not unusual. The competition has been particularly keen among the top generators—who are fighting a door-to-door battle for market dominance.

What started with the industrial customers, however, has now spread to smaller consumers. RWE Energie started the latest round of price cuts in August. RWE—which currently supplies some 2.3 million, or roughly 6% of Germany's 38 million households—decided that it wanted to double its residential market share. It launched a campaign called PrivatStrom—the term translates roughly to "domestic power"—offering something unprecedented in Germany. For the first time, a generator offered all German customers the same low prices regardless of where they reside or who they currently buy power from. Given the maddeningly complicated and controversial third-party access (TPA) and transmission pricing rules in Germany, RWE's offer was particularly bold and novel.

In essence, RWE said that it would charge all new customers the same low prices it now charges its current customers in its traditional service area. Moreover, RWE would figure out how to get the power to the consumer, would look after switching the customer including—presumably the costs of switching metering, billing and all the rest! To make its offer irresistible, RWE said that if any customer could find a better deal, it would further cut its costs to match or beat the lower price. How can you go wrong on an offer like this?

This, of course, is not an ordinary offer, nor is it coming from a fly-by-night operator. RWE was immediately deluged by phone calls from customers who wanted to switch. RWE, whose domestic tariffs are estimated to be roughly 20% below the national average (see Table), figured that it could double its market share by acquiring another 2.2 million customers from other regional and municipal utilities. This, however, assumes a static market where rivals sit and watch their customers walk away.

As one might suspect, however, RWE's rivals were not going to lay low and let this happen. And literally overnight, every major and many minor German utility launched their own counterattack, matching—and in some cases, beating—RWE at its own game. EnBW AG, based in Dusseldorf, the fourth largest generator, and an aggressive player in the German market, offered an even more amazing offer. Through a new supply subsidiary called Yello Strom, based in Cologne, the parent company offered an even lower price, countrywide! Other companies, notably VEW Energie, HEW and MVV Energie, have also come up with major price cuts, but none as spectacular (or suicidal?) as EnBW's.

Because of fixed and variable charges and a number of other complicating factors, it is hard to compare the bottom-line prices to consumers. But the price cuts now being offered in some cases are 60% below the current average national prices. Consumers couldn't be happier.

The bottom line? What's good for customers won't necessarily be good for the generators. Admittedly, the German power industry had been protected for too long and prices might have been padded in the past—but not by 20-30% or more. So it is not surprising that the recent price wars will

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have a negative—and noticeable—impact on company profits. Take the case of Veba. The Dusseldorf-based company recently reported a 15% *increase* in its *consolidated* sales relative to last year (the company does a lot more than just energy), but a 5% *fall* in operating profit in *electricity* sales.

What Does It Cost To Keep The Lights On In Germany?

National average electricity costs in the German residential sector for a household using 3,500kWh per year is estimated to be 32.5 Pf/kWh [roughly 17¢/kWh]. The average cost breakdown is as follows:

Component	% of Total Cost
Generation	40%
Transmission [1]	25%
Distribution [2]	9%
VAT & Concessions	26%

Source: VDEW

[1] Both high- and mid-level voltage transmission charges are included.

[2] This includes maintenance and operations of low-level voltage grid.

And In The UK?

Average residential customer in the UK pays an estimated $375 per year for electricity, broken down as follows:

Component	% of Total Cost
Generation	49%
Transmission	5%
Distribution	32%
Supply Costs including profit margin	13%
Fossil Fuel Levy	1%

Source: OFGEM

Veba said that it expects the profit figures to bounce back by the end of the year, but that may be wishful thinking. Even though Veba's electricity prices are among the lowest in Germany, and despite recent price cuts, the company has admitted that its current prices "may not be sustainable in the longer term." Further price cuts will result in even lower profits.

Its arch enemy, RWE, has also experienced the pressures of lower prices in the energy sector. One can always squeeze the costs a little here and a little there, but ultimately price wars will take their toll on profits. Perhaps that's the price to pay for bigger market share.■

Future IAEE Events

June 7-10, 2000	23rd IAEE International Conference Sydney Australia *Sydney Hilton*
September 24-27, 2000	21st Annual USAEE/IAEE North American Conference Philadelphia, PA, USA *Wyndham Franklin Plaza Hotel*
April 25-28, 2001	22nd IAEE International Conference Houston, TX, USA

Publications

Gas to Europe: The Strategies of Four Major Suppliers, edited by Robert Mabro & Ian Wybrew-Bond (1999). Price L 39.50. Contact: Oxford Institute for Energy Studies, 57 Woodstock Road, Oxford OX2 6FA, United Kingdom. Phone: 44-1865-311377. Fax: 44-1865-310527. Email: energy@sable.ox.ac.uk URL: http://associnst.ox.ac.uk/energy

Energy Demand in Asian Developing Economies, by M. Hashem Pesaran. (1998). Price: L 39.50. Contact: Oxford Institute for Energy Studies, 57 Woodstock Road, Oxford OX2 6FA, United Kingdom. Phone: 44-1865-311377. Fax: 44-1865-310527. Email: energy@sable.ox.ac.uk URL: http://associnst.ox.ac.uk/energy

The Economic Appraisal of Natural Gas Projects, by Willem J.H. Van Groenendaal. (1998). Price: L 39.50. Contact: Oxford Institute for Energy Studies, 57 Woodstock Road, Oxford OX2 6FA, United Kingdom. Phone: 44-1865-311377. Fax: 44-1865-310527. Email: energy@sable.ox.ac.uk URL: http://associnst.ox.ac.uk/energy

Oil in Asia: Markets, Trading, Refining and Deregulation, by Paul Horsnell. Price: L 39.50. Contact: Oxford Institute for Energy Studies, 57 Woodstock Road, Oxford OX2 6FA, United Kingdom. Phone: 44-1865-311377. Fax: 44-1865-310527. Email: energy@sable.ox.ac.uk URL: http://associnst.ox.ac.uk/energy

Electronic Energy Trading, a new report about electronic commerce and energy trading by Peter Fusaro and Jeremy Wilcox. Price $995. Contact: Global Change Associates, 211 West 56th Street, #23M, New York, NY 10019. Phone: 212-333-4979; Fax: 212-399-3471; E-mail: peterfusaro@global-change.com URL: www.global-change.com

Competition and Regulation in the European Electricity Industry, by Lars Bergman, Gert Brunekreeft, et.al. Price: $45.00. Contact: CEPR, 90-98 Goswell Road, London EC1V 7RR, UK. Email: orders@cepr.org. Fax: 44-171-878-2999. Phone: 44-171-878-2900.

Guide to the Economic Regulation of the Electricity Industry. (April 1999). Price: £125 Contact: OXERA Publications. Phone: 44-1865-251142. Fax: 44-1865-201080. Email: infoservices@oxera.co.uk

Strategic Hedging: Balancing Risk and Reward in the Oil Industry. Price: £5,000. Contact: Marketing Department, Centre for Global Energy Studies, 17 Knightsbridge, London, SW1X 7LY, United Kingdom. Phone: 207-309-3610/12. Fax: 307-235-4338. Email: marketing@cges.co.uk

Calendar

8-9 November 1999, Profit with Nuclear Power. Chicago, IL. Contact: Registration Dept., The Center for Business Intelligence, LLC, 500 W. Cummings Park, Suite 5100, Woburn, MA 01801. Phone: 781-939-2438. Fax: 781-939-2490. E-mail: cbireg@cbintet.com

8-9 November 1999, North American Gas Strategies Conference. Westin Hotel, Calgary, Alberta, Canada. Contact: Ziff Energy Group. Phone: 403-234-4285. E-mail: gasconf@ziffenergy.com URL: www.ziffenergy.com/nagsconference

9-10 November 1999, Border Energy Forum VI. San Antonio, Texas. Contact: Texas General Land Office, 1700 North Congress Ave., Austin, TX 78701-1495. URL: www.glo.state.tx.us/border

11-12 November 1999, 4th Annual Latin Upstream '99. Miami, Florida, USA. Contact: Fax: 281-597-9589. Email: global.pacific@pixie.co.za URL: www.glopac.com

17-18 November 1999, Asia LNG & Power '99. Shangri-La Hotel, Singapore. Contact: Ms. Gamar, Event Manager, 80 Marine Parade Road #13-02, Parkway Parade, Singapore 449269. Email:

(continued on page 32)

Calendar *(continued from page 31)*

gamar@cmtsp.com.sg Phone: 65-346-9132. Fax: 65-345-5928.

17-19 November 1999, FERC 101 & 102, Washington, DC, USA. Contact: The Energy Daily, 627 National Press Bldg., Washington, DC 20045. Phone: 202-638-4260. Fax: 202-662-9744. E-mail: kingcomm@kingpublishing.com

2-3 December 1999, Buying & Selling Oil & Gas Assets. Houston, TX, USA. Contact: Conference Connection, Inc, Raffles City, PO Box 1736, Singapore 911758. Phone: 65-226-5280. Fax: 65-226-4117. Email: info@cconnection.org

6-9 December 1999, The Energy Trader's Institute. Chicago, IL, USA. Contact: Infocast, 22134 Sherman Way, Canoga Park, CA 91303. Phone: 818-888-4444. Fax: 818-888-4440. Email: mail@informationforecast.com URL: www.information forecast.com

8-9 December 1999, The Geopolitics of Energy into the 21st Century. Monarch Hotel, Washington, DC. Contact: www.ftenergyusa.com or the Center for Strategic and International Studies – P-202-775-3209.

8-10 December 1999, Houston, TX. Mark Price Volatility: How to Model, Assess and Manager Price Volatility in Today's Power Markets. Contact: Infocast, 22134 Sherman Way, Canoga Park, CA 91303. Phone: 818-888-4444. Fax: 818-888-4440. Email: mail@informationforecast.com URL: www.information forecast.com

9-10 December 1999, Private Energy in Turkey '99. Washington, DC, USA. Contact: Registration Dept., Center for Business Intelligence, LLC, 500 West Cummings Park, Suite 5100, Woburn, MA 01801. Phone: 781-939-2438. Fax: 781-939-2490. Email: cbireg@cbinet.com. URL: www.cbinet.com

10-21 January 2000, Utility Regulation and Strategy. Gainesville, Florida. Contact: Public Utility Research Center, Warrington College of Business Administration, University of Florida, PO Box 117142 (Matherly 205), Gainesville, FL 32611-7142. Phone: 352-392-6148. Fax: 352-392-7796. E-mail: purcecon@dale.cba.ufl.edu. URL: www.cba.ufl.edu/eco/purc

12-14 January 2000, FERC 101 & 102, San Diego, CA, USA. Contact: The Energy Daily, 627 National Press Bldg., Washington, DC 20045. Phone: 202-638-4260. Fax: 202-662-9744. E-mail: kingcomm@kingpublishing.com

7-11 February 2000, CERAWeek 2000 – CERA's 19th Annual Executive Conference. Westin Galleria, Houston, Texas. For more information call Steven McCarthy at 617-441-1308 or visit www.cera.com/ceraweek

10-11 February 2000, Buying & Selling Oil & Gas Assets. Calgary, Alberta, CN. Contact: Conference Connection, Inc, Raffles City, PO Box 1736, Singapore 911758. Phone: 65-226-5280. Fax: 65-226-4117. Email: info@cconnection.org

5-7 March 2000, Middle East Petroleum & Gas Conference. InterContinental Hotel, Abu Dhabi, U.A.E. Contact: Vimla Mulchand, Managing Director, The Conference Connection, PO Box 1736 Raffles City Post Office, Singapore 911758. Phone: 65-226-5280. Fax: 65-226-4117. E-mail: cconnect@pacific.net.sg

4-6 March 2000, Electric Power 2000. Cincinnati, Ohio, USA. Contact: Electric Power 2000, 1220 Blalock Road, Ste. 310, Houston, TX 77055. Phone: 713-463-9595. Fax: 713-463-9997. E-mail: warrens@tradefairgroup.com URL: www.electricpower expo.com

8-10 March 2000, Renewable Energy for the New Millennium Conference. Sydney, Australia. Contact: Kelvin Kent, Phone: 61-2-9241-2955. Fax: 61-2-9241-5354. E-mail: meetings@tnm.com.au URL: www.esaa.com.au

12-14 April 2000, 5th Annual Energy Trading Summit, Orlando, Florida. Contact: Global Change Associates, 211 West 56th Street, #23M, New York, NY 10019. Phone 212-333-4979; Fax: 212-399-3471; E-mail: peterfusaro@global-change.com URL: www.global-change.com

IAEE Newsletter

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6-10 September 1999, Contracts in the Oil and Gas Industries: Negotiating and Drafting. University of Dundee, Scotland, UK. Contact: Mrs. Moira McKinlay, CEPMLP/University of Dundee, Dundee DD1 4HN, Scotland, UK. Phone: 44-1382-344303. Fax: 44-1382-345854. E-mail: m.r.mckinlay@dundee.ac.uk URL: www.cepmlp.org

9-10 September 1999, Oil Price Challenges into the Next Century. Houston, Texas. Contact: Samantha Holloman, Pennwell, 1700 W. Loop South, Suite 1000, Houston, TX 77027. Phone: 713-963-6251. Fax: 713-963-6212. E-mail: samantha@pennwell.com

13 September 1999, Sixth Grove Fuel Cell Symposium. London, UK. Contact: Phillipa Orme, Sixth Grove Fuel Cell Symposium Secretariat, 12 Church Street, West Hanney, Wantage, Oxon OX12 0LN, UK. Fax: 44-1235-868811. URL: www.elsevier.nl/locate/fuelcell99

13-14 September 1999, Oil and Gas in Brazil. Craine Plaza, New York. Contact: Jon Neale, Business Development, CWC Associates, Business Design Centre, 52 Upper Street, London N1 0QH. Phone: 44-171-704-6742. Fax: 44-171-704-8440.

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15-17 September 1999, PowerTrends. Philippines. Contact: Alice Goh Project Manager, Interfama International Pte Ltd., 1 Maritime Square #09-36 World Trade Centre Singapore 099253. Phone: 65-2766933. Fax: 65-2766811. E-mail: w2608@singnet.com.sg

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22-24 September 1999, 2nd International Energy Symposium – New Worlds. Stift Ossiach, Carinthia - Austria. Contact: Dr. A. Reuter, Verbundplan GmbH, Kohldorfer Strasse 98, A-9020 Klagenfurt, Austria. Phone: 43-1-536 05-32560. Fax: 43-463-23 97 29. E-mail: reutera@verbundplan.at

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27-28 September 1999, 1999 Market Forecasting Conference. Washington, DC. Contact: EPIS, Inc., 18813 Willamette Drive, West Linn, OR 97068. Phone: 503-675-0387. E-mail: ron@epis.com URL: www.epis.com

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4-6 October 1999, Middle East Strategy: To the Year 2012. Contact: APS House, PO Box 23896, Nicosia, Cyprus. Fax: 357-2-350265 E-mail: apsnews@spidernet.com.cy

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18 October 1999, SNS Energy Day 1999: Corporate Restructuring of the Global Energy Industry: Driving Forces and Implications. Stockholm, Sweden. Contact Judit Weibull, Phone: 46-8-507-025-74. Fax: 46-8-507-025-45.

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19-20 October 1999, European Electricity Summit. Europa Inter-Continental, Brussels. Contact: Global Business Conferences, Sycamore House, 5 Sycamore Street, London, EC1Y 0SG. Fax: 44-171-253-2798. Phone: 44-171-608-0541.

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26-28 Interactive Energy '99. Adam's Mark Hotel, Houston, Texas. Contact: Zeus Development Corporation, 2424 Wilcrest, Suite 250, Houston, TX 77042. Phone: 713-952-9500. Fax: 713-952-9526. URL: www.interactiveenergy.com

27-30 October 1999, 2nd International Exhibition on Electric Power Equipment and Technology. Shanghai, China. Contact: Crystal Chan, Project Executive, Adsale People, Inc., 4/F Stanhope House, 734 King's Road, North Point, Hong Kong. P 408-986-8384. Fax: 408-986-1580. E-mail: adsaleusa@worldnet.att.net

7-12 November 1999, The Gas Chain: From Reservoir To Burner Tip (Alphatania Training Course). Cricklade, Wiltshire, England. Contact: Esther Musoke, Course Administrator, The Alphatania Partnership, Rodwell House, 100 Middlesex Street, London E1 7HD, United Kingdom. Fax: 44-171-650-1401. E-mail: training@alphatania.com

8-9 November 1999, North American Gas Strategies Conference. Westin Hotel, Calgary, Alberta, Canada. Contact: Ziff Energy Group. Phone: 403-234-4285. E-mail: gasconf@ziffenergy.com URL: www.ziffenergy.com/nagsconference

7-11 February 2000, CERAWeek 2000 – CERA's 19th Annual Executive Conference. Westin Galleria, Houston, Texas. For more information call Steven McCarthy at 617-441-1308 or visit www.cera.com/ceraweek

8-10 March 2000, Renewable Energy for the New Millennium Conference. Sydney, Australia. Contact: Kelvin Kent, Phone: 61-2-9241-2955. Fax: 61-2-9241-5354. E-mail: meetings@tnm.com.au URL: www.esaa.com.au

11-12 April 2000, The 9th Annual Mediterranean Gas Conference. Tunis. Contact: EconoMatters Ltd., Rodwell House, 100 Middlesex Street, London E1 7HD. Phone: 44-20-7650-1430. Fax: 44-20-7650-1431. E-mail: confs@economatters.com. URL: www.gas-matters.com

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23-28 July 2000, ENERGEX '2000 Conference, Las Vegas, USA. Contact: Dr. Chenn Zhou at fax: 219-989-2898, e-mail: qzhou@calumet.purdue.edu or Dr. Brian Golchert at fax: 630-252-5210. E-mail: brian_glochert@qmgate.anl.gov

7-8 November 2000, 15th Annual Autumn European Gas Conference. Edinburgh. Contact: EconoMatters Ltd., Rodwell House, 100 Middlesex Street, London E1 7HD. Phone: 44-20-7650-1430. Fax: 44-20-7650-1431. E-mail: confs@economatters.com. URL: www.gas-matters.com

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Electric Utility Planning and Regulation, Edgard Kahn (1991). 339pp. Price $27.00. Contact: American Council for an Energy-Efficient Economy, 1001 Connecticut Avenue, NW, Suite 801, Washington, DC 20036.

Turning Off the Heat: Why America Must Double Energy Efficiency to Save Money and Reduce Global Warming, Thomas Casten (1998). 269pp. Price $26.95. Contact: American Council for an Energy-Efficient Economy, 1001 Connecticut Avenue, NW, Suite 801, Washington, DC 20036.

European Power Daily. Subscription. Price $1200/year. Contact: Standard & Poor's Platt's, Wimbledon Bridge House, 1 Hartfield Road, London SW19 3RU, United Kingdom. Phone: 44-181-543-1234. Fax: 44-181-545-6269.

World Energy Outlook. 1998 Edition. Price $120.00. Contact: IEA Publications, PO Box 2722, London W1A 5BL, United Kingdom. Phone: 44-171-896-2245. Fax: 44-171-896-2244.

China's Oil Industry and Market, H.H. Wang (1999). 428 pp. Price: $100.00. Contact: Elsevier Science, PO Box 211, 1000 AE Amsterdam, The Netherlands. Phone: 31-20-485-2603. Fax: 31-20-485-2425.

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