IAEE INTERNATIONAL ASSOCIATION FOR ENERGY ECONOMICS

Newsletter

Published by the Energy Economics Education Foundation, Inc.

Editor: *AMS Inc.* **Contributing Editors**: *Paul McArdle, Tony Scanlan and Marshall Thomas*

First Quarter 1999

President's Message

I AM WRITING this President's message on behalf of Hoesung Lee who unfortunately is unable to write it himself.

1999 is going to be a challenging year for energy markets and the energy industry around the world. Change is afoot in much of the energy world. We have entered the year with oil prices at their lowest levels in real terms since 1973. Oil producing nations and companies are thus facing the task of adapting to a most difficult lower price environment. Producers of other hydrocarbon fuels, especially natural gas, have not been able to escape price weakness either.

Meanwhile, electricity markets in a very wide range of countries, not least the United States, are in transition as deregulation widens and deepens. Few players in power markets will be immune from fundamental change.

At the same time, environmental issues are high on the policy agenda in many countries. The issue of climate change has remained at the forefront into 1999 after the Buenos Aires Meeting of Parties built on the Kyoto Agreement. Policymakers are now embroiled in developing strategies and specific actions in order to begin to meet the legally binding commitments that they have made to reduce carbon emissions.

And what is more, energy markets in many emerging market economies in Asia, Latin America and the Former Soviet Union are in transition, having been severely affected by the financial and macroeconomic disruptions that have developed over the last year.

All these developments will ensure that energy and environmental issues will remain both topical and of high importance globally. The IAEE and its affiliates around the world have both the opportunity and obligation to contribute constructively and meaningfully to the ensuing policy debates. Our obligation is to ensure that the debate is both well informed and rigorous. I wish to encourage the membership everywhere to participate and to contribute positively and meaningfully wherever and whenever the opportunity emerges.

I particularly want to draw your attention to the IAEE International Conference that will take place in Rome in June and the regional conferences in Orlando, Florida in August and Oxford, UK and Paris, France in September when these and other issues will be addressed. I hope that you will be able to attend at least one of these events.

I look forward to meeting as many of you as possible, particularly at these conferences. I also hope that you will contact me with your suggestions as to how the IAEE can be more effective in contributing to these debates and to serving you, the membership.

With my best regards,

Peter Davies
President-elect
(email: daviespa@bp.com)

Editor's Note

The title of Michael Lynch's article on oil price and production forecasting might well be *How can so many be so wrong so often and for so long*. He looks at the continuing upward bias in price forecasts and downward bias in production forecasts and concludes that the most important lesson of the past is that the consensus can be horribly wrong and that there is an abundance of bias in this forecasting despite an implication of scientific objectivity. He goes on to look at the reasons for these biases, concluding that these forecast failures have been due to the adoption and defense of bad theories. Turning to the subject of oil crises he argues that these are the result of short term price spikes due to a supply disruption stemming from some political event. He looks at the three components of an oil crisis and how the typical response policies to these are likely to impact the situation.

Peter Catania reports on the ENERGEX98 conference held in Bahrain, summarizing the comments of more than fifteen speakers/sessions.

With this issue of the *Newsletter* we welcome the

(continued on page 30)

!!! MARK YOUR CALENDARS — PLAN TO ATTEND !!!

The Structure of the Energy Industries: The Only Constant is Change

20th USAEE/IAEE Annual North American Conference – August 29 – September 1, 1999
Orlando, Florida, USA – Hilton at Walt Disney World Village

Announcement and Call for Papers

Economic upheaval, globalization, privatization and regulatory reform are having significant impacts on energy markets throughout the world. All of the major energy industries are restructuring through mergers, acquisitions, unbundling and rebundling of energy and other services. This conference will provide a forum for discussion of the constantly changing structure of the energy industries, with insights into the causes and likely outcomes of the restructuring efforts that are not underway. Some of the major conference themes and topics are as follows:

Oil Industry Restructuring
Natural Gas Markets in the New Century
Global Gas & Power
The Climate Change Debate
Electricity Restructuring
Alternative Fuel Vehicles

The Global Economy and its Effect on the Energy Industry

At this time, confirmed and/or invited speakers include the following:

Kathy Abbott, Columbia Gas (invited)
Joe Foster, Newfield Exploration
Knut Anton Mork (invited)
Matt Simmons, Simmons & Company
Jeff Skilling, ENRON (invited)
Scott Woronuik, TransCanada Pipelines (invited)
Steven P. Brown, Federal Reserve Bank of Dallas
Michael C. Lynch, MIT
Adam Sieminski, BT Alex Brown, Inc.
Kyle Simpson, Morgan Meguire, LLC
Ronald Sutherland, American Petroleum Institute

In addition, 25 concurrent sessions are planned to address timely topics that affect all of us specializing in the field of energy economics. Sessions under development or consideration include:

Modeling Competitive Electricity Markets
Environmental Analysis and Regulation
Oil Supply Outlook: International Projections
Evolving U.S. Natural Gas Markets
Latin American Deregulation
Globalization of the Electricity Industry
Energy Modeling: Past, Present and Future
A New OPEC?
The Outlook for Coal and Nuclear Power
Doing Energy Business in the Information Age: Removing the Barriers
Energy Reform in Transition Economies
Environmental Issues in the Developing World
U.S. Oil Policy
Global Change: Economic and Energy Policy Implications
Energy Efficiency in a Glutted Market
Market Power in the Transmission Industries – (NG & Electricity)
Distributed Generation
Convergence in the Utility Industries

Anyone interested in presenting a paper or organizing a session should propose topics, motivations, and possible speakers to:

Mary Lashley Barcella - 202-429-6670 / mlbarcella@msn.com or Mine K. Yucel - 214-922-5160 / mine.k.yucel@dal.frb.org

Abstracts should be between 200-1500 words and must clearly address the theme of the conference and topics above to be considered for presentation at the meeting. At least one author from an accepted paper must pay the registration fees and attend the conference to present the paper. All abstracts/proposed sessions and inquiries should be submitted to: David Williams, Executive Director, USAEE/IAEE28790 Chagrin Blvd., Suite 350, Cleveland, OH 44122 USA Phone: 216-464-2785 / Fax: 216-464-2768 / E-mail: iaee@iaee.org

The 20th USAEE/IAEE Annual North American Conference provides a unique opportunity for leading experts from business, government, universities, and research institutions to discuss and debate the future of energy markets in this era of commodization, decentralization, and internationalization.

The meeting will emphasize the applicability of the most recent, cutting-edge analysis for helping private and public organizations frame decisions and choose appropriate strategies.

In the past, USAEE/IAEE conferences have attracted outstanding speakers. You can be sure that prominent speakers who are on the cutting-edge of energy economic issues will once again address this annual meeting.

Orlando, Florida is a wonderful and scenic/tourist place to meet. Single nights at the Hilton Hotel are $139.00 (contact the Hilton Hotel at 407-827-4000, to make your reservations). Conference registration fees are $475.00 for USAEE/IAEE members and $575.00 for non-members. Special airfares have been arranged through Continental Arilines. Please contact Continental by calling 281-821-9549 and reference our discount code "IMBGHT." These prices make it affordable for you to attend a conference that will keep you abreast of the issues that are now being addressed on the energy frontier.

There are many ways you and your organization may become involved with this important conference. You may wish to attend for your own professional benefit, your company may wish to become a sponsor or exhibitor at the meeting whereby it would receive broad recognition or you may wish to submit a paper to be considered as a presenter at the meeting. For further information on these opportunities, please fill out the form below and return to USAEE/IAEE Headquarters.

The Structure of the Energy Industries: The Only Constant is Change

20th Annual North American Conference of the USAEE/IAEE

Please send me further information on the subject checked below regarding the August 29 – September 1, 1999 USAEE/IAEE Conference.

____ Submission of Abstracts to Present a Paper(s) _____ Registration Information _____ Sponsorship Information _____ Exhibit Information

NAME: _____ TITLE: _____
COMPANY: _____
ADDRESS: _____
CITY,STATE,ZIP: _____
COUNTRY: _____ PHONE/FAX: _____

USAEE/IAEE Conference Headquarters
28790 Chagrin Blvd., Suite 350
Cleveland, OH 44122 USA● Phone: 216-464-2785; Fax: 216-464-2768

22nd IAEE Annual International Conference

New Equilibria in the Energy Markets: The Role of New Regions and Areas

Rome, Italy 9-12 June 1999

Grand Hotel Parco dei Principi

Organized by the IAEE Italian Affiliate - AIEE

The Conference will be composed of 10 general sessions and 40 concurrent sessions with an expert team of 200 distinguished speakers who will give those attending a clear picture of the commercial, regulatory and competitive sectors currently emerging in these markets.

Some 200 abstracts have already been submitted, dealing with new energy markets, the experiences of liberalisation, regulation and deregulation in the energy markets, Post-Kyoto follow up, energy scenarios, energy demand and efficiency and the role of technologies in a sustainable development.

The Conference will be a unique opportunity to debate about current developments with high-level representatives of key industry and international institutions who have already confirmed their participation, among which ENI, BP, SHELL, ENEL, EDF, SNAM, BG as well as IEA, IPCC, IFP, World Bank and the European Commission, all representing more than 35 countries.

The Official Opening will be held by the Italian Minister of Industry, Mr. P. Bersani, followed by the keynote address of Mr. Guglielmo Moscato, Chairman of ENI. The general sessions will then debate on the issues related to the Kyoto Protocol Implementation, New Region and Big Projects, the Electricity Markets in the Mediterranean, Gas Demand and Supply in Europe, the Evolution of Big Energy Company in the 21st century and Technologies Innovation.

The Closing Remarks will be addressed by the Director of EC and by the Italian Under-Secretary of Foreign Affairs.

In addition to a highly professional programme, the Conference will be the opportunity for delegates and accompanying persons to enjoy many cultural visits and social events throughout Rome.

A private guided visit to the Vatican Museums and the Sistine Chapel will be organised on June 9; the following day, participants and their guests will be invited to a gala dinner in a XVIIIth Villa and on June 11 an exclusive concert in a Roman Basilica will be offered to them. At the end of the conference, on June 12 all ladies will be invited to a special fashion show at Grand Hotel Parco dei Principi.

Before the Conference, on June 7 and 8 a variety of interesting technical tours will be organised for participants to provide them with on site presentation to some industrial plants located in three Italian attractive regions and to make them enjoy Italy's wealth of art and culture: participants will have the opportunity to visit ENEL geothermal fumeroles and power stations in Lardarello (Tuscany), ENI offshore gas platforms at Ravenna (Adriatic Sea) and ENEA Photovoltaic R & D Center at Portici (Naples).

Other cultural tours and excursions throughout Rome, Florence and other cities will be offered at special rates to delegates and accompanying persons.

For further information or registration details, please contact:

Cristiana Abbate
AIEE - Associazione Italiana Economisti dell'Energia
Via Giorgio Vasari, 4 – 00196 Rome, Italy
Phone +3906 322.7367 Fax +3906 323.4921
Email: aieeconference@mclink.it

Oil Scarcity, Energy Security and Long-term Oil Prices—Lessons Learned (and Unlearned)

*By Michael C. Lynch**

Lately, the energy community has been treated to the very entertaining spectacle of catastrophic warnings of imminent petroleum scarcity at the same time that prices are reaching 50 year lows. For a price forecaster, it is somewhat satisfying to see such stark reminders that price does indeed matter, and for a long-time price bear, it is definitely reassuring to see "heresy" prove true. But as an academic, it is disheartening to see the degree to which even the most basic, obvious lessons have gone unlearned, not just by the media, but by people who are supposed to be the experts.

Given the degree to which impending energy scarcity and looming vulnerability to oil crises are being cited both to explain oil company mergers and justify investments in alternative energies, it seems valuable to revisit the issues.

How Did We Get Here?

In the 1970s and 1980s, hundreds of millions of dollars were spent studying the energy crisis by scores of university centers and non-profit research organizations and thousands of individual researchers. Hundreds of books and thousands of articles were written, perhaps fifty major, world-scale studies were performed and at least two dozen computer models of the world oil market were constructed. The analyses were done by oil companies, governments and multinational organizations, as well as environmentalists, consultants and academics, some of whom went on to lead ivy-league business schools and win Nobel prizes for economics. The great majority of this work created a very solid, widely-agreed upon consensus about the nature of the oil crisis and the future direction of oil prices. This consensus not only proved to be wrong but was demonstrably stupid.

Unfortunately, the recent collapse in oil prices, which seems to have caught nearly everyone by surprise, demonstrates that the lessons haven't been learned (or perhaps they aren't even being studied). In the 1986 oil price collapse, there was a bumper sticker seen in Texas reading, "Grant me one more boom and I promise not to screw it up again!" Yet in 1996 and 1997, when short-term market tightness raised oil prices, the industry promptly spent it all, causing the rental rates for drilling rigs to double. Now, with lower prices, financial ratings are plummeting and companies are laying off workers by the thousands, as if they had never seen weak prices before. Perhaps oil companies should diversify into the bumper sticker business.

Forecasting for Fun and Profit (and Maybe Accuracy)

How can so many be so wrong? First, of course, it has to be recognized that there are many rationales for producing or using a long-term forecast. In theory, forecast producers and consumers would want as accurate and unbiased a forecast as possible, but real world practice is another matter. Partly, this reflects the knowledge that no forecast is ever going to be perfectly accurate, and forecast accuracy can be known only long after the fact. Still, even if acquiring an accurate forecast was merely a question of finding the right forecaster or spending enough money, that doesn't mean that it would suit the purposes of all consumers.

Forecasts are often used to determine strategy, policy, and budgets, among other things. As a result, depending on the organization and the person within the organization, there can be strong biases towards either pessimism or optimism. An oil company forecast might be biased towards high prices, because that will raise the value of its stock and justify more investment spending. Alternatively, managers might prefer a low price forecast to encourage cost-cutting. Oil service companies have a natural bias towards price bullishness, since they wish to encourage upstream investment by their customers. Consultants prefer to give their clients what they want (as do academics, all too often).

Similar behavior can be seen in governments, depending on the country (oil importing or OPEC) and the Ministry in question (Finance, Energy, Commerce). Most OPEC governments should be expected to be biased towards optimism about both prices and demand for their oil, although in many cases Finance Ministries and Central Banks tend towards pessimism. Officials in one oil exporting country told me that they preferred conservative production forecasts because their politicians were inclined to overspend projected revenue.

There is also a bureaucratic bias towards conservatism, since most forecasters, given uncertainty about forecast accuracy, will prefer to emulate the consensus. This may not be optimal for their organization, but it is best for them personally, as they are less likely to be punished for producing an inaccurate forecast if it resembles the consensus.

Forecasting Oil Prices

In the early 1990s, there were few articles on price forecasting and an often-implicit consensus around flat prices in the long-term. Yet recently, there has been a resurgence of pessimistic forecasts, with Campbell (1997) leading the charge, and the IEA following along. (DOE has so far resisted the peer pressure.) That these warnings have been wrong before does not, in and of itself, prove their inaccuracy now. (That will be done below.)

Until the mid-1970s, it was common to assume that prices would be flat in the future, although after 1973, they were assumed flat at a much higher level. (See IEA 1977, for example.) But beginning in the late 1970s, as Lynch (1994) showed, many analysts became convinced that real oil prices must inevitability increase, on the order of several percent per year, despite the fact that such trends had never been observed.

These projections have proven to be much too high. The average error for 1997 (before the latest collapse) in the oil price forecasts submitted from the computer models participating in EMF6 (1982) is 540%; for EMF11 (1991), 75%. None was too low. Similarly, at the International Energy Workshop, from 1981 to 1985, 81 of 82 forecasts of 1990 oil prices were too high. Indeed, only a few isolated consultants and academics argued that higher prices were not inevitable. (Lynch 1994 has a more detailed review.)

This rising-price consensus was driven by a combination of factors, including misinterpretations of Hotelling's work as proving that oil prices should rise at the rate of interest and

*Michael C. Lynch is Executive Director of Asia Energy and Security, Massachusetts Institute of Technology, Cambridge, MA. He is also president of the United States Association for Energy Economics.

OPEC's announced long-term strategy of real price growth matching the trend in OECD economic growth. Both implied (for vastly different reasons) that prices would rise by a few percent per year over the long-term, and so price forecasters assumed such real price growth regardless of external market conditions. Major forecasters like the U.S. Department of Energy repeatedly predicted 3-4% per year oil price increases, even as market conditions varied wildly, and a variety of academics (Pindyck 1978, MacAvoy 1982) argued that natural trends in supply and demand would drive prices upwards. As oil prices fell throughout the 1980s, forecasters who revised their predictions merely lowered the initial point to conform to the new actual level, but continued to predict ever-rising prices.

Forecasting Petroleum Supply

The pattern of errors in forecasts of oil supply may be different, but a pattern there is. Before 1979, many of the oil supply forecasts tended to be too optimistic, often assuming that the 1973 price increase would lead to a substantial non-OPEC production rise. But by 1977, and especially after the Iranian Oil crisis, the psychology shifted. Despite higher oil prices and increased drilling, oil production forecasts were *lowered*, and since that time, nearly all non-OPEC production forecasts have been too low.

To a fair degree, oil supply in the non-OPEC Third World can easily be forecast through extrapolation. However, as I discussed in (Lynch 1996a), the tendency has been to assume that beyond the horizon, production would peak and decline, almost without regard for the geographic location, the maturity of petroleum exploitation (well density, field size, etc.), or the local regulatory regime (taxes and royalties, price controls on crude oil sales, monopoly production by national oil company). It is hard to find a forecast after 1980 that predicts rising production for any region or country but the Middle East and Mexico. Yet except for the United States, oil production has increased consistently in nearly all of these countries.

In fact, almost all forecasts of oil production since the late 1970s have relied on similar arguments: new giant fields are not being found, oil companies are not replacing their reserves, the Middle East contains the bulk of oil reserves, investment is focussed not on exploration but more intensive development of existing reserves, costs are low only because of cyclical depressions in service industries and must, therefore, rise, decline rates are very high in the North Sea and the Gulf of Mexico and investment cannot replace reserves, and new technologies like horizontal drilling will have only a limited application. (Brown et. al. 1979, MacKenzie 1996 as two examples)

Much of this is true, but it has been true for twenty years, yet still non-OPEC production rises. Again and again, forecasters have been forced to raise the projected peak and move it out (the reverse of price forecasting). Inasmuch as these forecasts typically show near-term production peaks in every region, from mature oil producers like the United States to the non-OPEC Third World, which has hardly been touched, it seems clear that the forecasts themselves are inherently biased to produce near-term peaks. Certainly, neither the economics of the industry nor the geological record supports such conclusions. (Lynch 1996b provides evidence of resource abundance.)

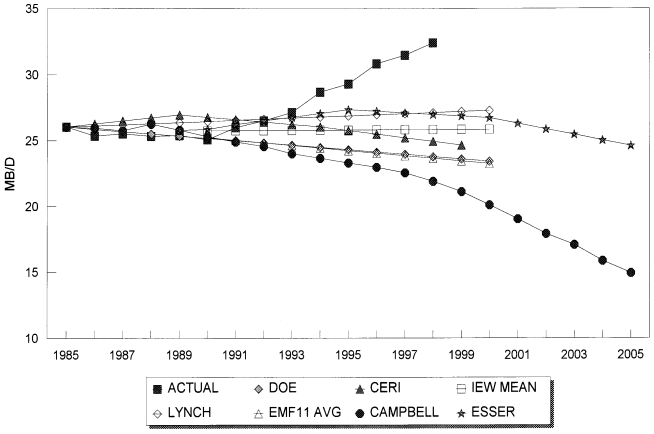
Welcome to the Club (of Rome)

Recent work by Hatfield (1997), Edwards (1997) and particularly Campbell (1997) have predicted the peaking of not just OECD oil production or non-OPEC oil production, but world oil production. Campbell (1997) is the most extreme of these views, arguing that true world oil resources are only 1.8 trillion barrels, significantly less than the 1994 USGS estimate of 2.4 trillion, and only 180 billion barrels remain to be discovered, which results in an approximate production peak this year. Since these authors are all geologists, and published in prestigious journals, including *Nature* and *Scientific American*, their work has received a lot of attention and is assumed credible.

However, as Lynch (1996a) described, the method they use is flawed, treating ultimately recoverable resources (URR) as a fixed point when it is in fact a dynamic variable. It refers not to total resources, but to the recoverable portion of total resources, which naturally increases with changes in technology, infrastructure, price and other factors. The most widely cited estimates, by the USGS, have tended to increase over time, and even Dr. Hubbert, who developed this method, relied on estimates for global oil resources of 1.25 trillion barrels, 20% less than actual discoveries to date.

Although it is too early to measure the validity of the very long-term forecasts of Edwards and Hatfield, Dr. Campbell's work can be assessed, since he has been publishing for ten years. And in fact, his forecasts precisely conform to the predictions of Lynch (1996a), namely, he is too pessimistic, he constantly revises his estimates of URR upwards, and he repeatedly increases the predicted peak production level while always delaying it a few years into the future. Figure 1 shows that his 1991 forecast of non-OPEC oil production was far worse than those of the other major forecasters. The error in his 1991 forecast of non-OPEC, non-FSU production is over 8 mb/d by 1997.

Figure 1
Non-OPEC Production Forecasts
1989/91



And despite Campbell's claims that the accuracy of the database he relies on allows extraordinarily precise estimates of recoverable resources, he has also increased his estimate of URR. His 1991 book estimated global URR at 1.65 trillion

(continued on page 6)

Oil Scarcity, Energy Security… *(continued from page 5)*

barrels, and his 1997 book used a figure of 1.8 trillion barrels. The increase of 150 billion barrels is almost exactly the same as oil consumption during that period, implying that he sees the oil industry at a steady state—replacing reserves as fast as they are being consumed—even though he himself does not seem to perceive the implications of his own analysis.

OPEC Market Power and Competitiveness

Thus, most forecasters, such as the International Energy Agency, are clearly exaggerating both the inability of non-OPEC production to increase and our future dependence on the Middle East, as they have done in the past. But even allowing for optimistic views of prices and non-OPEC production (as in Lynch 1996b), there is no question that OPEC market power and the share of oil from the Middle East will grow.

Certainly, the market power of OPEC has improved from the mid-1980s, when prices collapsed. And while most OPEC countries are now focussing on increasing production capacity, rather than stabilizing prices, policies can change. Conceivably, OPEC could become a more effective cartel and raise prices at some point in the future.

But the likelihood that OPEC could regain enough power to duplicate its performance from 1974-1985 seems remote. OPEC oil revenue has declined so dramatically since the late 1970s (and even the mid-1970s) that even the optimistic forecasts do not show revenues reaching the levels of the late 1970s for ten to fifteen years. And current revenues are trivial on a per capita basis when compared to the mid-1970s, approximately one-third of the peak in the early 1980s, and only one-half the level of the mid-1970s. The 8-10% revenue growth which has been projected by the supply pessimists for the past twenty years would restore OPEC's strength fairly soon, but as real revenues have been flat for more than a decade, it seems more likely that the day when OPEC's financial power is restored remains distant.

However, even if renewed OPEC power were a concern, the "solution" to potential future increases in oil prices is not to invest now in expensive energy sources, by subsidizing biomass or geothermal or mandating electric vehicles or other technologies. No question, some technologies are seeing growing market penetration, but their proponents need to adopt much more realistic views of their value and stop relying on arguments about intangible benefits, such as protection from potentially higher prices in the future and reductions in energy insecurity (discussed below).

Pupils, Apt and Inept

Sometimes it feels as if forecasters are harder to train than laboratory mice, given their inability to learn what appear to be fairly clearcut lessons. In fact, the most important lesson is that the consensus can be horribly wrong, that the most well-funded studies, the most prestigious experts, the most August bodies can all produce work which is simplistic and flawed. Although self-interest may have been a factor in some cases (oil companies, environmentalists, etc.), the dominance of the rising-price consensus shows how easily swayed even allegedly independent academic economists can be by fairly superficial arguments that conform to short-term events.

Another lesson is the abundance of bias despite the implication of scientific objectivity. Because data are either unavailable or poor and given the uncertainty about many of the parameters, forecasters are often forced to choose and assume parameters, making it all too easy for an expert to assemble abundant data and citations to support nearly any argument. (Global climate modelers, be warned.)

That there is bias is apparent from two different factors. First, the overwhelming percentage of forecasts whose prices are too high and competitive oil supply forecasts which are too low is proof of forecasting bias. But also, it is abundantly clear that many forecasters are deliberately biased in their work. The repeated citation of Hubbert's successful prediction of the lower-48 U.S. oil production is a good example, since Campbell and others do not mention Hubbert's mistaken prediction that by 2000, world oil production would be 34 million barrels per day and U.S. gas production would be 8 Tcf, both errors exceeding 100%. Similarly, the IEA's treatment of the debate between optimists and pessimists relies heavily on Campbell's work while ignoring work such as Lynch (1996a) which refutes it. (This after arranging for both sides to debate the issues in Paris.)

A common misperception is that forecast errors were due to mindless extrapolation, which failed when trends changed in the 1970s. In fact, forecasting failure has been due to the adoption and defense of bad theories which underlay misspecified models and encouraged the manipulation of forecast components to support those theories. The error in price forecasting is in the reliance on a trend line of 3-4% annual real price increases and the error in oil production forecasting has been the generation of a near-term peak and decline for areas with abundant oil resources. Yet many forecasters have responded to their error by ignoring past errors, retaining the incorrect trend and changing the initial point.

This can be seen in the forecasts from EMF6 and EMF11, which were 10 years apart (1980 and 1990, approximately). The ten world oil models at the former predicted price increases over the subsequent twenty years on average of 3.6% per year, with a range of 1.9-5.3%. The latter forecasts did have lower error rates for 1997, but in truth, they produced nearly identical forecasts for the twenty years following: an average increase of 4.6% per year, and range of 2.1-7.0%. On petroleum supply, Campbell, the IEA, and others, have consistently produced pessimistic forecasts and consistently revised them upwards.

Inasmuch as bees have been proven capable of extrapolation, it would be rather embarrassing to think that energy forecasters are capable of no more than this, the most primitive of methods. But extrapolation has not been the source of forecasting error. If forecasters had extrapolated oil prices from the historical trend of 1870 to 1970, they would have been very wrong from 1974 to 1985, but otherwise, fairly accurate. And extrapolation of non-OPEC, non-U.S., non-FSU production from 1950 would have also generated forecasts far superior to any actually produced.

Of course, extrapolation does not always work. Predicting prices from 1974 to 1985 would require knowledge of cartel theory and OPEC policy, while U.S. oil production has been responding to depletion and rising costs, as well as to price changes (in both directions) and technological advances. This is fortunate, or energy economists could be replaced by spreadsheets.

Energy Insecurity

Some might interpret the above arguments to suggest that energy security is no longer an issue, that there is no likelihood of another oil crisis. However, this misinterprets oil crises as representing oil scarcity and long-term rising prices. In fact, they are short-term price spikes due to oil supply disruptions stemming from political events.

But as with oil price forecasting, there have been numerous warnings of vulnerability and imminent crises, repeated by the same experts again and again for the past twenty years, so that many interpret alarmism about oil crises with the same skepticism that they do Malthusian warnings about long-term oil scarcity.

The Goal of Access

Nations have often worried that they will be denied oil/energy at some critical time, or that the threat of denial will give an opponent political leverage over them. Indeed, Britain, France, Italy and Japan all set up national oil companies, to ensure that they would be able, in the long run, to maintain "access" to oil supplies. To some degree, these moves represented industrial policy, but they have typically been defended as crucial to energy security.

It would be unfair to dismiss these concerns out of hand, even though the number of oil embargoes has been few. Primarily, this is because the oil market has so typically been in surplus that companies, nations and colonial empires sought to encourage the export of petroleum, not use their power to preserve it for themselves. The most famous exception is the Anglo-American oil embargo of Japan in 1941. At that time, the vast majority of the international oil industry was controlled by seven British and American companies which gave their governments' enormous power over world oil trade. These same companies now control only 10% of the world's (non-U.S., non-FSU) production, as opposed to about 90% in 1941.

The Arab Oil Embargoes of 1967 and 1973 are often cited as examples of the political use of oil as a weapon, although the Embargo of 1967 was such a complete failure that few policy makers are aware of it. But even the 1973 Embargo has often been misinterpreted—many recall the price increases, the gasoline lines, and the mad diplomatic scramble for oil, but the embargo on sales which was imposed on the United States and the Netherlands had no practical effect. The oil industry managed to swap supplies of crude from embargoed nations to unembargoed nations, evenly sharing the cutbacks. Prices increased because of the production cutbacks, and gasoline lines were largely the result of consumer panic and government mismanagement.

Policy makers have continually worried that factories would close or citizens go cold because of a lack of oil supply. Yet during both oil crises, factory closings and gasoline lines were rare and short-lived and usually caused by government mismanagement, not a physical lack of oil. True, factories closed and unemployed workers could not afford gasoline, but due to the macroeconomic effects of the oil crises. Inflation levels shot up around the world, two severe recessions were caused, and estimates of lost GNP range into the trillions of dollars. Yet according to those who think that obtaining "access" to oil is the primary energy security goal, there were no crises.

The True Nature of Oil Crises

Some of the experts argue that oil markets are now efficient and that it is better for governments not to interfere during an oil crisis, that oil is not a "strategic commodity". To some degree, this is true. If there is a supply disruption, markets are far more efficient at allocating oil than governments are, although it is often overlooked that markets "clear" through the mechanism of price; if there is no oil to allocate, higher prices reduce demand and thus balance the market. In fact, the implication is that the 1970s events were not oil crises, because markets cleared and the higher prices are just a natural part of that.

But three factors suggest that there remain "strategic" concerns about oil: Oil is valuable, oil is concentrated in politically unstable areas, and oil burns or blows up. Because oil is valuable, it tends to be targeted by labor and/or opposition groups looking for ways to put pressure on their governments. Nowhere is there such a vulnerable concentration of wealth as in an oil pipeline.

The most important difference between a political disruption of supply and a logistical disruption is the uncertainty which the political element causes. Since supply uncertainty is a major driver of hoarding, which has been one of the most important elements in oil market turmoil during the crises of the 1970s, there is a direct, causal connection between politics and oil crises.

There are essentially three components to an oil crisis: a supply disruption, the transformation of the disruption into a crisis, and the economic damage caused by the price increase *in that order*. If a supply disruption can be prevented, no further measures are needed. If it occurs, but can be blocked from developing into a crisis, then all other policy problems are irrelevant. But the last line of defense is to minimize the impact of any crises that occur. Since different policies are useful at different stages, the value of a given approach can be more readily identified by this formulation. A detailed discussion of crisis management policy can be found in Lynch (1998), but here, the question of energy security premiums and the role of alternative energies will be addressed, inasmuch as it relates to the perceived long-term value of different forms of energy.

There are two types of policies which are traditionally advocated to reduce energy security: surge capacity and import minimization. Surge capacity can reduce vulnerability by deterring economic blackmail by oil exporters, and can replace disrupted supplies, which can minimize hoarding. Thus, surge capacity can not only deter some disruptions, but prevent disruptions from turning into a price spike, avoiding economic dislocation altogether without distorting markets.

Import minimization, including energy taxes and subsidies or other assistance for petroleum substitutes, primarily reduces the economic impact of price increases after they have occurred. Reducing oil imports has at best an indirect effect on the size of the disruption, with no impact on the size of surplus capacity. Indeed, by reducing oil exporters' revenue, it could hasten the political upheavals which cause disruptions of oil supplies.

But it is essential to recall that the goal is to reduce economic damage, not to satisfy some primeval urge for fuel. Continually paying twice as much money for solar energy to

(continued on page 8)

Oil Scarcity, Energy Security… *(continued from page 7)*

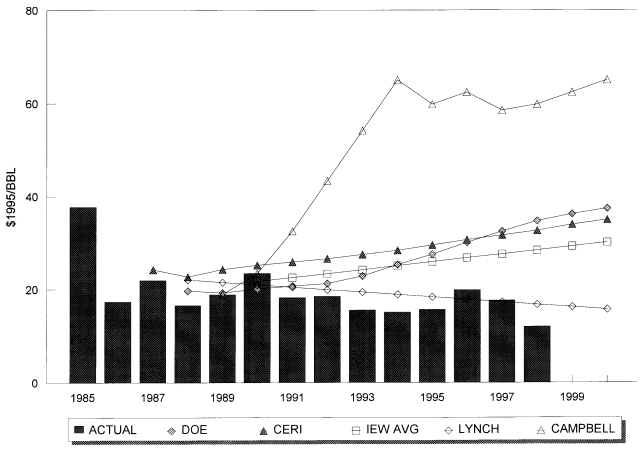
avoid the economic damage from a six month, 50% price spike every ten years is hardly cost-effective. And strategic petroleum reserves are by far the cheapest form of surge capacity. Renewables are usually capital intensive, which is not desirable for back-up capacity, nor are most forms of alternative energies usable in transportation, the primary need during an oil crisis.

The security premium, then, depends on the expectations of the size of future crises and the area under the price spike, which is highly uncertain. In the 1970s, there were two major spikes, in the 1980s, none, and only one moderate one so far in the 1990s. What does this tell us about the probability and size of future oil price spikes? Sadly, not much. But arguments that they will be more prevalent and severe in the future are based more on alarmist concepts than sound evidence.

Expectations

Analyzing recurring errors to recognize theoretical mistakes leads to the simple correction of removing the assumption of peaking oil production and rising prices. This was done in my 1989 publication, which was labeled "heretical" by the *Petroleum Economist* (9/89 p.4) for predicting lower prices in 2000 but has proven moderately accurate. (Figure 2)

Figure 2
1989 Price Forecasts



Many uncertainties remain about oil market developments, including economic growth in Asia, reform in Russia, the role of Iraq, development of Caspian pipelines, as well as OPEC policy, but it is clear that petroleum is abundant and the next decade will see continued price volatility as OPEC struggles to maintain prices. Sadly, the most likely development over the next few years is that billions of dollars will be lost by companies that believe predictions of oil scarcity and rising prices or invest in substitute energies expecting to receive a large security premium.

The surprise is not that oil prices have failed to rise, despite having been predicted to do so by so many experts. And the embarrassing factor is the refusal of so many to recognize their errors and correct them. (Only a few major forecasters, like DOE and the Gas Research Institute, have modified their expectations, for which they are to be applauded.) When hard scientists find that data doesn't match their theory, ignoring the data is not the preferred solution. The theory must be corrected or abandoned. The continued attention to repetitions of forecasts that have persistently proved incorrect is the biggest unanswered question in energy economics.

Sources

Brown, Lester R., Christopher Flavin, and Colin Norman, "The Future of the Automobile in an Oil-Short World," Worldwatch Paper 32, September 1979.

Campbell, C. J., *The Coming Oil Crisis*, Multi-Science Publishing Company & Petroconsultants S.A. 1997.

Edwards, John D., "Crude Oil and Alternate Energy Production Forecasts for the Twenty-First Century: The End of the Hydrocarbon Era," *AAPG Bulletin*, August 1997.

Energy Modeling Forum, *World Oil*, 2 vols., Stanford University, Stanford, California, December 1982.

Energy Modeling Forum, *International Oil Supplies and Demands*, EMF Report 11, Vol. I., September 1991.

Hatfield, Craig Bond, "The Oil We Won't Have," *Washington Post*, 10/22/997 A21

International Energy Agency, *World Energy Outlook*, 1977.

Lynch, Michael C., "The Wolf at the Door or Crying Wolf: Fears about the Next Oil Crisis," in El Mallakh, Dorothea, ed., *Energy Watchers IX*, The International Research Center for Energy and Economic Development, Boulder, Colorado, 1998.

Lynch, Michael C., "The Analysis and Forecasting of Petroleum Supply: Sources of Error and Bias," in *Energy Watchers VII*, ed. by Dorothea H. El Mallakh, International Research Center for Energy and Economic Development, 1996. (1996a)

Lynch, Michael C., *International Petroleum Price, Supply and Demand: Projections Through 2020*, Gas Research Institute, January 1996. (1996b)

Lynch, Michael C., "The Fog of Commerce," Center for International Studies Working Paper, 1992, subsequently published as "Bias and Theoretical Error in Long-Term Oil Market Forecasting," in *Advances in the Economics of Energy and Natural Resources*, John R. Moroney, ed., JAI Press, 1994.

Lynch, Michael, *Oil Prices to 2000*, *Economist Intelligence Unit*, May 1989.

MacAvoy, Paul W., *Crude Oil Prices as Determined by OPEC and Market Fundamentals*, Ballinger 1982.

MacKenzie, James, "Heading Off the Permanent Oil Crisis," *Issues in Science and Technology*, Summer 1996.

Pindyck, Robert S., "Gains to Producers from the Cartelization of Exhaustible Resources," *Review of Economics and Statistics*, May 1978.

IA
EE

CALL FOR PAPERS

1999 EUROPEAN CONFERENCE OF ENERGY ECONOMICS

- TECHNOLOGICAL PROGRESS AND THE ENERGY CHALLENGES -

Paris, 30 september - 1 october 1999

The energy sector is the field of rapid technological progress under the effect of the competitive strategies of companies and technological policies. Technological forces allow changes in institutions and industrial organisation, and stimulate the development of competition, Technology can also make a difference on long-term energy challenges: foreign oil dependence, resources exhaustion, environmental protection, risk of climate change.

The conference aims at providing an opportunity to look back on the economic, industrial and environmental effects of the technological development of the last twenty-five years and assess the respective efficiency of the private innovation strategies and public policies. This past experience can give indications on the future direction of the technical change, its elements of dynamics and the possibilities to act on it to face the critical energy and environmental issues that will affect us in the next century.

Co-Chairmen of the Conference

Georges BOUCHARD
(Gaz de France)

Denis BABUSIAUX
(Institut Français du Pétrole),

Members of the Scientific Committee

Ezio ANDRETA - Science, Research and development - Director Energies - European Commission - Belgium
John CHESSHIRE - University of Sussex - UK
Edgardo CURCIO - Italian Association for Energy Economics - Italy
Wilfried CZERNIE - Ruhrgas - Germany
Georges DUPONT-ROC - Shell - UK
Dominique FINON - Chairman of the Scientific Committee - France
Arnulph GRUBLER - International Institute for Applied Systems Analysis - Austria
Jean-Eudes MONCOMBLE - Electricité de Fance - France
Gérard SARLOS - Ecole Polytechnique de Lausanne - Switzerland
Yves SMEERS - Université Catholique de Louvain - Belgium
Antonio SORIA - Institute for Prospective Technological Studies - Spain,
Fritz VAN OOSTVOORN - Netherlands Energy Research Foundation - The Netherlands

THEMES OF THE CONFERENCE

Driving factors and constraints on technical progress in the energy sector:

- Relationship between energy and growth,
- Role of the cultural and political environment (environmental constraints, geopolitics, etc.),
- Role of energy, R & D and fiscal policies,
- Role of corporate strategies and industrial structures,
- Role of cross-fertilization and spillovers from equipment industries.

Technical progress and changing structures of energy industries and markets:

- Emergence of decentralised systems (economies and externalities),
- Impact of new information and production technology,
- Competition and innovation strategies in the production processes,
- Changes in the supply induced by innovation and competition : from the energy commodities to the energy service.

Technical progress at the service of sustainable growth:

- Technological innovation as an answer to the climate change issue,
- Incentives and barriers to technical progress in enhancement of energy supply resources,
- Development conditions for renewable energies and efficient technologies,
- Scope for technology transfer (e.g., by joint implementation, tradable permits, etc.)
- Liberalised markets: what incentive for long term R & D for sustainable development ?

Technological progress, energy modelling and prospects:

- Advances in the integration of technological progress in different types of modelling (sectorial, macroeconomic; bottom-up versus top-down; etc.),
- Integration of technical progress in long term scenarios and forecasting,
- Methods for the analysis of efficiency of market-based instruments and R & D policies.

Abstracts may be submitted for plenary as well as concurrent sessions and should be between 300 and 1500 words, giving an overview of the topic to be covered. Please include the title of the paper, name of the author(s), address(s), telephone, fax, and e-mail numbers when submitting your abstract. English and French will be the languages of the conference with simultanous translations for plenary sessions, and English the language for other sessions. A reduced registration fee will be offered for the author(s).

All inquiries and abstracts should be directed before **1 march 1999** to :

Dominique FINON, Programme Chairman of the Scientific Committee
Institut d'Economie et de Politique de l'Energie - B.P. 47 38040 GRENOBLE CEDEX 09 - FRANCE
finon@iepe.upmf-grenoble.fr

Submission of abstracts : 1 March 1999
Notification of abstract acceptance : 1 april 1999 - Manuscript submission paper : 30 july 1999

ENERGEX'98

Report on the 7th global energy forum held in Bahrain under the auspices of the International Energy Foundation.

*By Peter Catania**

The ENERGEX'98 conference focused on the technical, economic and human dimensions related to the growth and development of all forms of energy. It was held under the patronage of His Excellency Sheikh Isa Bin Ali Al-Khalifa, Minister of Oil and Industry, Government of Bahrain with the conference chairman being Dr. Mohammed J. K. Al-Ghatam, President, University of Bahrain.

International experts from 50 countries discussing renewables, fossil fuels, case studies on the rational use of energy, risk assessment, energy modeling, energy economics, global climate change and other related topics formed the basis of the technical and plenary sessions.

The conference opened with statements from the Minister of Oil and Industry, the President of the University and the Chairman of the International Energy Foundation.

His Excellency Sheikh Isa Bin Ali Al-Khalifa, Minister of Oil and Industry, pointed out that the Government of Bahrain has always striven to exploit its native energy resources in order to develop their country, raise the standard of living of their citizens and create the necessary infrastructure for a modern, progressive state while at the same time avoiding negative ecological consequences.

He further noted that much importance was attached to developing and identifying the special needs of the workforce in the field of energy; in developing the institutional framework and encouraging research in the energy industry. And that Bahrain was especially concerned with the impact of energy on regional, inter-Arab and international relations.

His excellency went on to note that in spite of its successes, the government of Bahrain is now convinced that to continue to depend on oil and gas as its main source of revenue and the prime mover of the national economy requires revision and re-thinking during the coming years, especially with the constant instability in international prices. Thus, Bahrain intends to speed up its efforts to diversify its income sources and lessen dependence on oil as the major exportable commodity. He noted the Arab region has almost limitless possibilities in the field of renewable energy, especially solar, wind and biomass energy.

Dr. Al-Ghatam pointed out that the technology and industrial progress the Western countries have witnessed was due primarily to the discovery of new technologies which were basically built on the discovery of and refining of oil. While the Gulf states owe their rapid progress and advanced civilization over the past 50 years to the oil industry, that does not mean ignoring the pollution which this industry and it's branches leave on the natural environment, human life, animals and plants. Bahrain, for its part, took a clear ecological direction when it decided to use oil in petrochemical industries and natural gas in generating electricity and water desalination by observing the standards applied internationally which ensure protecting it's atmosphere from all types of pollutants. The utilization of energy has relieved Bahrain of a great deal of suffering and hard labor and doubled productivity to the degree that physical work contributes no more than 1 percent of the work accomplished in the industrialized countries. Although it is true that the oil industry has moved the Gulf Region States from poverty to prosperity, it is not true that the Gulf States are not concerned with the search for substitute and renewable energy sources, he noted. For, example the State of Bahrain has established an Energy Research Centre.

The conference also provided the opportunity to discuss the technological, economic, social and environmental impacts of the various forms of energy. The author indicated that following the Kyoto protocol, several major themes have emerged with researchers worldwide: These are; (1) A need for strong government leadership and vision in all countries in the promotion of energy efficiency and renewable energies, (2) Market distortions must be removed but these alone are not sufficient to promote energy efficiencies and the mass introduction of renewables. Government is needed to counterbalance those market structures which hinder energy developments. (3) It is essential that the developing countries be involved in the mitigation of global climate change. We must also recognize that these countries have priorities which are significantly different than those of developed nations. Their priorities are economic development from the ground level and the alleviation of poverty. (4) The protocol mechanisms must be flexible and transparent. (5) Business has a key role in the transformation from an oil economy to a renewable energy economy. (6) The importance of applied R & D in the mitigation of climate change cannot be overemphasized. (7) The diversity of many developing nations needs to be recognized and the costs of inaction or the "do nothing" approach will be far greater than that of action. (8) Developed countries must redirect their economies and technologies drastically and developing countries must start to do as well. (9) The most cost effective way is energy efficiency, that is, using less and using it wisely. (10) Low energy prices have undercut the motivation for energy efficiency.

The protocol is only a first and initial step towards a sustainable energy future, however ambitious it is. Nations will limit their emissions in accordance with their level of economic development. In the interim, effective policies and technical experts can assist in establishing more energy efficient systems whether or not climate change is considered a policy priority. The need is for reformation, transparent and flexible policies.

The expertise would have considerable value added if it helped regions within developing countries address their growing needs, alleviate poverty and strengthen their educational system.

Professor G. O. P. Obasi, Secretary General World Meteorological Organization presented the view that historic climate changes have been essentially free of human influence but the enormous growth in energy utilization since the industrial era, largely in the form of fossil fuel, has altered atmospheric chemistry by increasing the concentration of earth-warming greenhouse gases, particularly CO_2. Since pre-industrialized times, N_2O has increased by about 14 percent and methane by about 150 percent. The atmospheric lifetime for carbon dioxide is 50-200 years, methane 12 years and perfluorocarbon 50,000 years. It is clear that the only way of stabilizing these gases is through stopping the emissions completely. Based on energy utilization scenarios from

* Peter Catania is Chairman of the International Energy Foundation.

global population, economic land use growth, technological changes, energy availability and fuel mix through the next century, global warming is predicted to occur at a rate higher than in the last 10,000 years. For the mid-range scenario the minimum predicted global temperature increase is 2^0C over the next 100 years. At a minimum it will take some 100 years to stabilize temperature changes and the effects on the mean sea level over this same time period will be a continued rise of a minimum of 50 cm. Stabilization of greenhouse gases as envisaged under the Kyoto Protocol marks only a first step towards curtailing this warming. Recognizing that fossil fuels will remain the major source of primary energy for the forseeable future, the challenge is to find energy options, including cleaner and alternative technologies, renewable sources and more efficient utilization, which would provide legitimate long-term sustainable development while sharply reducing emissions to minimize or remove the threat of global climate change.

Dr. Moukhtar Al-Lababidi, Director of Technical Affairs, OAPEC, Kuwait stated that the Arab countries proved reserves were estimated at about 643 billion barrels of oil (BBO) and 32.5 trillion cubic meters (TCMG) of natural gas. About 220 BBO and 6 TCMG have been produced since 1914 and the current proven reserves represent 62 percent and 21.7 percent of the world's proved reserves of oil and gas, respectively. Undiscovered potential petroleum reserves in the Arab oil producing countries is estimated to range between 134 and 160 billion barrels of oil and more than 20 trillion cubic meters of gas. In other Arab countries the estimate is 29 billion barrels of oil. In addition, there are substantive reserves of oil in oil shale. These reserves will carry the world well into the next century.

Dr. Peter Doerell , World Energy Council and Editor of the International Coal Newsletter presented the view that there are three postulates of any energy source, that is, safety of supply, low cost, and environmental acceptability. Of these the first is the most critical since energy is the lifeblood of a modern society and any energy shortage can be very costly. However, with growing environmental awareness throughout the world, future energy will have to be as clean as technically possible and economically viable. Dr. Doerell put forth the concept that the accusations that a growing carbon dioxide concentration from the use of fossil fuels will lead to climate disaster is totally unfounded.

These and other technical and economic discussions related to the carbon tax were eloquently summarized in the plenary presentation by Dr. Anwar Al-Abdullah Director of Oil and Gas Department, Secretariat General, The Cooperation Council for the Arab States of the Gulf, Saudi Arabia. Protecting and nourishing the environment has been, and remains an integral part of our social and economic existence. Often the position of the oil producers is not adequately understood by those who are in a hurry to monopolize environmental concerns as if to suggest that we have no concern for our common home. We cannot hope to achieve meaningful co-operation without an understanding of each other's views and underlying concerns. Selfish interest makes no sense any more as the Earth's environment knows no boundaries and the world is truly more interdependent than ever. At the heart of the debate should be the issue of development. The World Bank estimates that more than one billion people still live in acute poverty and suffer grossly inadequate access to resources required to give them an opportunity for economic development. It is unrealistic to attempt to envisage global economic development without the use of energy, especially oil. Oil is the lynchpin of industrial civilization. While there is an explosion of knowledge in the field of climate change, there is still general agreement that continued research is needed to reach an objective assessment of the causes and effects of climate change. We could argue forever about greenhouse gases and climate change but it is more relevant to focus on the issues on which we should all agree, namely creating a healthy environment for economic growth and development and creating the atmosphere for stability and predictability in the oil market.

Further taxation of energy or oil under different forms, whether it be carbon taxes, import fees or some combination of these, does not help us to achieve these goals. Such taxes, whether for environmental motives, efficiency gains, protecting domestic production or merely for budgetary reasons, often sacrifice the underlying objectives of economic growth.

Many studies have questioned the effectiveness of carbon taxes in reducing carbon dioxide concentrations, The rationale is that such taxes operate through the price mechanism and give appropriate market signals to cut consumption and clean the environment. However, in reality, the energy markets in most of the industrialized countries, and especially in Europe, are far from perfect. Further taxes would simply aggravate such market imperfections.

The discrimination against oil in many of these countries has reached a point where taxes on the barrel of petroleum products is three to four times the price of a barrel of oil. At the same time coal, which emits more carbon dioxide than oil per unit of energy, has received generous subsidies, especially in Germany and Japan. Had such petroleum taxes or coal subsidies been readjusted according to environmental criteria and not merely a budgetary objective, the world environment would be cleaner without constraining growth and the final consumer would now be paying less at the gasoline station.

The GCC's record on the environment shows that we are supportive of international efforts to bring the important issues of sustainable development and environmental protection into international energy policy. However, we feel that there is a growing danger that environmental tax policies are misguided and could have a potentially disastrous affect on the international economy. The OECD's own extensive studies show that indiscriminate consumer taxes are not the least-cost, most economically efficient approach to combating global warming and reducing air emissions. On average oil contains about 21 percent less carbon than coal. Yet, we find that there is still considerable prejudice against oil, as a front-line energy source. After all, oil is taxed heavily enough as it is and far in excess of any contribution it may have in the environmental degradation.

Dr. Al-Abdullah conclude by reference to the total aid given to the developing countries over the last two decades. This averaged some 5.5percent of GDP which compares with the 0.7 percent of GDP recommended by the UN and seldom reached by the industrialized nations. The GCC shares the view of the World Bank that poverty in the developing countries rather than the carbon dioxide issue is the root of

(continued on page 12)

ENERGEX'98 *(continued from page 11)*

global degradation. The scope for environmental upgrading is much larger in the developing countries and the developed countries should help the developing countries in advancing in the most rapid way possible through the transfer of technologies rather than through the imposition of additional taxes on energy.

Guy Caruso, Executive Director, Strategic Energy Initiative, Center for Strategic International Studies, in his plenary session referred to the IEA projections that world energy demand will grow by 66 percent and carbon dioxide by 69 percent between 1995 and 2020 unless new policies are in place to curb energy use and greenhouse gas emissions. And fossil fuels are expected to provide 95 percent of additional global energy demand to 2020. Additionally he stated that the supply will be mainly from the Middle East and the liquid fuels from nonconventional sources like heavy oils and tar sands will continue to play an increasingly important role as 2020 is approached and that the price of fuel will continue to rise. Substantive reduction in greenhouse gases are required to meet the commitments agreed in the Kyoto Protocol.

Caruso also pointed out that new policies will be required if nuclear power and non-hydro renewable energy sources are to help to reduce the future rates of growth of fossil fuel consumption and greenhouse gas emissions. These policies would need to encourage the development and demonstrations of new designs for less costly nuclear power plants and determine the locations for permanent repositories for radioactive wastes. Unit costs of renewable energy must be reduced and , in some cases, environmental problems must be solved.

Energy intensity will continue to fall, as in the past, through the introduction of new technologies, economic and industrial restructuring and the substitution of commercial for non-commercial fuels. In light of the stability of past energy trends, major new policies will be required to provide the necessary market incentives to speed up reductions in energy intensity in order to stop the growth in carbon dioxide emissions. These policies will need to take account of economics, social and political constraints.

Rapidly growing electricity demand and the need for climate-friendly technologies in non OECD countries will require foreign investment to support financing from domestic sources. This, in turn, may require restructuring, privatization and regulatory changes in the electricity industries in these countries.

Michael Lynch, MIT, United States. presented evidence to show that the economic projections on the price of oil are inconsistent with reality. All projections since the 1970's have indicated that the price of oil will rise in the future and when one returns to the mid 70's projections we should now have prices in the order of $90 per barrel! This is a far cry from the present value hovering about $12. In spite of this reality, the economic projections still forecast escalating prices. Lynch pointed out that his forecasts on oil prices were the lowest, yet, still predicted prices which were beyond reality. Perhaps we need to revisit the many assumptions and assertions which are used in the computer generated forecasts in order to be able to predict with a reasonable degree of certainty the future costs of oil? These forecasts are driven in part by pessimistic supply forecasts. However, those supply forecasts are flawed because of the omission of key variables, which invariably lead to predictions of a near-term peak and decline, almost without regard for the geological and economic circumstances of an area.

Unconventional energy producers should be careful, therefore, to avoid optimism about the future market environment, and must focus on cost reductions and other improvements in order to gain competitiveness, rather than relying on market changes to deliver market share to them.

The recent introduction of horizontal drilling as presented by Michael Wilson and Peter Catania clearly pointed out that the advances in technology due in part to incentives provided by government has had a positive effect on the reserves and productivity of wells which were economically marginal using the standard vertical well technology. In one region within the Province of Saskatchewan 50 percent of the annual production is from horizontal wells. This is just one of the many new technologies which will result in increasing reserves and enhance production with positive economic results.

Several presentations on renewable energies clearly indicated their economic viability and one such case was reported from Italy where geothermal energy was used in greenhouses. The most important conclusion was that production was possible when market prices for the products was four to five times more than the regular price in the normal growing season. Ziegelmann *et al*. Discussed the impact of renewables in Germany and concluded that the conventional power industry will suffer most from an extension of renewable energy systems. While the net employment effect is positive when reducing carbon dioxide emissions by 10 percent within 20years (approximately +3,800 employees), the balanced net effect is negative in the case of a rapid expansion of renewable energy systems in order to lower the carbon dioxide emissions by 24.1 percent (approximately -9,100 employees).

The elements associated with the clean image of renewable energies was tackled by Dr S. A. Abbasi from India wherein he presented steps that should be undertaken to insure that the renewable energies do not suffer from the same environmental backlashes of the type we got from hydropower projects.

John Tande, the representative of the Norwegian Electric Power Research Institute, discussed the implications of exploiting wind energy in proximity to weak electric grids. The number of ways to overcome this potential bottleneck are as follows: (1) Grid reinforcement by installation of new lines, (2) dissipation of wind energy, (3) application of energy storage, (4) introduction of load management and (5) regulation of reactive power. He described and illustrated these through the presentation of the results of actual experiences from relevant wind power projects. By applying the methods described above more wind power can be connected economically to weak grids.

In the case of biomass, Mohammed Sheya and Salvatory Mushi from Tanzania stated that biomass accounts for 92 percent of Tanzanian final energy consumption and will continue to dominate the national energy balance. Fuelwood and agricultural residues used to meet domestic energy needs account for 80 percent of the domestic energy requirements while commercial energy such as kerosene, electricity and liquefied petroleum gas account for 1 percent. Total biomass

resources for 1990 were 27.0 million tonnes of oil equivalent. While there are efforts to develop other renewable sources of energy such as solar, wind and minihydros, there are also problems hindering their development. They include the lack of adequate data on the actual potential of these sources as well as lack of local capacity to design and manufacture energy related equipment and spare parts. The comments of these and other authors and researchers reaffirmed the need for fostering the transfer of technologies and industrial capacity and capability to meet the needs of society within developing nations.

Dr. Boris Berkowski of the World Solar Commission described the work of UNESCO and presented the results of the World Solar Summit held in 1996. The three main results of the Solar World Summit can be summarized as follows: Renewable energies are recognized as being an important component of the energy sector in the 21st century and as being worthy of development and use on a large scale in the coming decade. The decision was made to launch Solar World Programme 1996-2005 as a common effort of national governments, specialized agencies and programmes of the United Nations, inter-governmental and non-governmental organizations, university and research institutions and the private sector. The outline of the World Solar Programme 1996-2005 was approved and a working decision was made to elaborate a full-fledged WSP document by July 1997. UNESCO was invited to continue to play a leading role in the WSP preparation. It is vital that each and every research organization in the world be actively involved in this programme by receiving a formal letter of invitation which can then be presented to the national government wherein the organization is headquartered so as to have substantive global input from both the developed and emerging nations.

Other authors presented case studies and experimental results on the utilization of renewable energies such as the characterization of photovoltaic generators in Switzerland (Dr. William Durisch), reverse osmosis using photovoltaic systems in Oman (V.K. Sharma).

Within the section on energy policies and economics several issues were presented in addition to those of the plenary speakers. Dr. Mandouh Salameh, an international oil market expert, said "In 1995, OPEC was producing at only 55 percent capacity. By 1997 utilization had risen to 95 percent. No wonder then, that the *capacity question* has been termed oil's perennial problem. The delimma confronting producers is either they face the danger of over-investing if demand grows slowly or not at all, or they run the risk of investing too little, too late. Yet, without outright investment, the capacity constraint may start to bite at some point in the near future. One has to seriously consider the possibility of a third oil crisis capable of again disrupting the global economy, triggered by political upheaval in the Middle East.

Henrich Lund described the plans of Norway to move from a centralized power generating economy to a decentralized system based on energy efficiency at individual places of consumption and renewable energy systems adopted to local conditions. This change demands not only technical modifications, but also large organizational changes, which will often comprise the establishment of completely new organizations. The case of electric heating conversion illustrates how public regulation has resulted in reductions in carbon dioxide emissions together with the creation of 150 jobs. It is projected that in the near future more than 1000 permanent jobs can be created without negative consequences for the balance of payments. This is one example that other countries should examine on how to transfer the concepts in Norway to their specific energy economy.

Klimenko from Russia presented a different perspective on the issue of a carbon tax. He concluded that for actual climate protection an implementation of a global carbon tax seems unnecessary. It was argued that adequate measures on forest preservation and restoration will be more effective and universal.

Barry Barton , School of law, New Zealand discussed the legal difficulties that may be encountered in reforms where the electricity and gas industries are being exposed to market liberalization. Contract law, energy sector regulation and competition law are some of the more obvious legal issues but he argues that a wider range of questions such as privacy and human rights must also be taken into account. This fresh approach allowed for a systems analysis of energy deregulation.

Many other perspectives on the systems analysis of energy were included in sessions related to waste energy and environmental control, architecture, coal, thermal storage, energy modeling and risk assessment.

The Jane Carter Prize

The British Institute of Energy Economics, the International Association for Energy Economics and the Association for the Conservation of Energy invite the submission of essays for the 1998-99 award of the Jane Carter Essay Prize. The prize for 1998-99 will be a cash award of US $800 together with a plaque.

Essays can be on any aspect of energy efficiency and conservation or on aspects of general energy and environmental policy which are relevant to energy efficiency. The aim is to encourage new thinking on these subjects. The emphasis of the essay should, therefore, be on the policy, rather than the scientific or technical, aspects of the subject.

The competition is open to anyone under the age of thirty-five. Essays should not be more than 8,000 words long. They can be based on work done for another purpose, e.g., an academic thesis or policy report, but the results of that work should be presented in an original form. The wining essay will be considered for publication in a range of energy and environmental journals.

Essays should be submitted in English, in triplicate and typed form by 30 June 1999 to:

Mary Scanlan, Administration Secretary
British Institute of Energy Economics
37 Woodville Gardens
London W5 2LL
United Kingdom

Each essay should include a 150 word summary. The name, address and age of the author should be on a separate sheet which can be detached from the essay which will be judged anonymously. Manuscripts will not be returned.

Iran, OPEC, and the World Oil Market: An Analysis of the Data Behind the Quota Disputes

*By Fereidun Fesharaki and David Isaak**

The issues of Iran's quota and whether Iran is overproducing or not, has been cited as a key element weakening the price of oil in the recent past. That Iran had agreed to cut back production by 305 thousand barrels per day (kb/d) is not in dispute. What is in dispute is the level from which the production should be cut back. In other words, what is the baseline of production? Iran insists that the baseline production should be 3.942 million b/d. OPEC, relying on selected secondary sources, puts Iran's baseline production at 3.623 million b/d. It appears that in the spirit of cooperation, Iran was inclined to reach an agreement with OPEC. Later Iran reiterated its position on production baseline for March 1998 and so informed OPEC in written communications after both the June and November OPEC meetings.

This dispute has been cited as one of the reasons behind the uneventful OPEC meeting in Vienna in November 1998. Along with Venezuela, which is apparently 125 kb/d short of its pledged 525 kb/d output cut, many are holding these two countries responsible for the lack of recovery of oil prices despite OPEC's valiant efforts to reduce output.

Is Iran Really Overproducing or Simply Refining and Consuming More Oil?

Whether Iran is overproducing or not, boils down to understanding the details of the Iranian data. We believe that most analyses of the Iranian oil industry, have not taken into account serious changes in Iran's refining and oil trade data.

We have requested and received detailed Iranian data which are quite consistent with our own data and analysis of the market. While we cannot independently ascertain what exactly the Iranian production was in the first quarter of 1998, we feel comfortable that the Iranian data is generally and directionally in line with our own data independently obtained over a long period of time.

There is little doubt that Iran's oil refining capacity increased significantly in early 1998. As shown in Tables 1 and 2, Iran's refining output had slowly increased from the 1993 level of 1.088 million b/d to 1.134 million b/d in 1997. This corresponds to crude feeds of 1.14 and 1.19 millionb/d, respectively. In 1998, the full commissioning of the long delayed Bandar Abbas refinery as well as an almost 50 kb/d debottlenecking at Abadan refinery increased the refinery output by nearly 220 kb/d and the additional feed by 230kb/d. Iran's refinery capacity currently stands at 1.524 million b/d as shown in Table 3.

The key factor behind Iran's addition to capacity is the rising oil demand in Iran and prospects of larger and larger oil imports. Several years ago, Iran instituted regular price increases to slow down demand for oil products. While these policies were initially highly effective, their impact has began to wear down. In 1998, we estimate oil demand in Iran will rise by 83 kb/d or over 6 percent. Gasoline demand alone is likely to grow by some 10 percent in 1998.

---

*Fereidun Fesharaki and David Isaak are with the East-West Center in Honolulu, Hawaii where Fesharaki is Director of the Energy Program. The article is reprinted from the East-West Center's Energy Advisory, Number 224, December, 1998.

Table 1
Iran's Refinery Production and Product Balances
(thousand barrels per day)

Year	Refinery Output	Refinery Feed	Imports	Exports (Fuel Oil Only)
1993	1,088.7	1,137.2	131.7	110.6
1994	1,120.6	1,170.6	131.4	119.2
1995	1,119.3	1,177.8	138.0	113.7
1996	1,130.8	1,185.5	135.0	105.8
1997	1,134.7	1,190.0	165.1	138.4
1998*	1,354.3	1,420.0	31.4	235.3

Note: *January to October 1998.

Table 2
1997 vs. 1998*
(thousand barrels per day)

	Volume	% Change
Additional Refining Output	219.6	19.30
Additional Crude Feed	230	19.30
Reduced Imports	133.4	81
Increased Exports	96.9	70
Change in the Net Product Trade	230.6	—

Note: *January to October 1998.

Table 3
Iran's Refining Industry, 1998
(thousand barrels per day)

Unit/ Location	Crude Distri-tion	FCCU	Hydro-cracker	Cat. Refor-mer	Vis-breaker
Northern Refiners					
Tabriz	112	—	18	11.12	16.5
Tehran	225	—	29.4	27.27	35
Arak	150	—	24.5	21.6	27.3
Isfahan	265	—	30	29.5	38
Kermanahah	30	—	—	2.8	—
Total	782	—	101.9	92.28	116.8
Southern Refiners					
Shiraz	40	—	9.28	6.2	9
Abadan	450	30	—	26	—
Bandar Abbas	232	0	28	36	31
Lavan	20	—	—	—	—
Total	742	30	37.28	68.2	40
Total Capacity	1,524	30	139.18	160.84	156.8

The significant increase in Iran's refining capacity explains the drastic changes in Iran's oil product trade. Iran has long been an oil product importer. Between 1993 and 1996, Iran's oil imports were in the range of 131 to 138kb/d, consisting of gasoline, kerosene, and gasoil. In 1997, Iran's product imports rose to 165 kb/d (see Table 4). Meanwhile, Iran has consistently been an exporter of fuel oil from Abadan. Fuel oil exports in 1996 were 106 kb/d and 1997 exports were 138 kb/d.

Table 4
Iran's Product Imports
(thousand barrels per day)

	1997	1998*
Gasoline	42	31.4
Kerosene	53.8	0
Gasoil	69.3	0
Total	165.1	31.4

Note: *January to October 1998.

The data for the first 10 months of 1998 suggest a

dramatic change. Imports declined by 133 kb/d with the start up of the new refinery units. Kerosene and gasoil imports in 1998 were non-existent for the first time in a decade. Gasoline imports fell by over 25 percent. All in all, Iran's product imports fell by 81 percent between 1997 and 1998. Meanwhile, exports of fuel oil rose drastically by 70 percent to nearly one quarter of a million barrels per day. *In short, Iran went from a net product importer to a net exporter with a total change in the net product trade of over 230 kb/d.* This happened concurrently with the increase in oil demand of some 80 kb/d.

Iran's Crude Oil Production, Exports, and Refining

The crude oil production data reported by NIOC and the average of six secondary sources used by OPEC, establishing the baseline, have never been consistent. Indeed, according to NIOC compiled data from 1993 to 1997, the secondary sources reported Iran's production higher than NIOC's data. Indeed, in 1993, secondary sources reported a higher production than NIOC by a massive 218 kb/d! Since 1998, the tables have turned. The secondary sources have reported lower production than NIOC by an average of 150 kb/d for the first 10 months of the year. The difference for March 1998 of over 300 kb/d is the largest and for June 1998, the smallest at 30kb/d as shown in Table 5, supplied by Iran's Ministry of Petroleum.

Iran's oil exports moved from 2.2 million b/d in January 1998 to 2.6 million b/d in April 1998, before dropping to under 2.4 million b/d in May 1998. Between July and October 1998, Iran reports exports were at around 2.2 million b/d.

While Table 5 reflects the Iranian position, it is consistent with the data shown earlier on refining and trade. It reflects the new capacity additions, stockbuild for refining and some de-stocking later.

Table 5
Iran's Crude Oil Production and Disposition
(thousand barrels per day)

Year	Crude Oil Production, NIOC	Export	To Refinery	Crude Oil Production Average of 6 Secondary Sources	Difference*
1993	3,425	2,288	1,137	3,643	-218
1994	3,595	2,424	1,171	3,600	-5
1995	3,595	2,417	1,178	3,607	-12
1996	3,595	2,409	1,186	3,666	-71
1997	3,603	2,413	1,190	3,654	-51
1998+					
January	3,782	2,155	1,263	3,619	+163
February	3,795	2,205	1,271	3,611	+184
March	3,925	2,474	1,342	3,623	+302
April	3,781	2,605	1,412	3,725	+56
May	3,776	2,378	1,426	3,582	+194
June	3,778	2,556	1,445	3,748	+30
July	3,624	2,200	1,424	3,550	+74
August	3,620	2,202	1,418	3,408	+212
September	3,615	2,205	1,410	3,453	+162
October	3,618	2,206	1,412	3,420	+198

Notes:
*Crude oil production, NIOC minus crude oil production average of 6 secondary sources.
+Includes stock build for the Bandar Abbas refinery.
Source: NIOC/Ministry of Petroleum.

Conclusions

The average data from secondary sources shown in Table 5 do not reflect any production change during the commissioning of Bandar Abbas refinery or the debottlenecking of the Abadan refinery. Nor do they reflect the massive shift in Iran's product trade position or increasing domestic demand. Basically, the average number of the secondary data is not consistent with the changing refining, oil demand, and oil product trade position of Iran.

Again, while we cannot say with certainty which are the accurate numbers, it is pretty clear that the secondary sources did not fully account for important changes in the structure of Iran's oil industry.

It seems reasonably clear that Iran's additional refining capacity, high domestic oil demand, and changes in oil product trade position, imply that Iran's production could not be far off from the levels claimed by Iran. It is possible, and even likely that the secondary sources not having access to updated export/import and domestic demand surge data, as well as the exact timing of the commissioning of Bandar Abbas or debottlenecking of Abadan, underestimated Iran's production in March 1998. Clearly, a big part of the difference of 300 kb/d between Iran's official position and the secondary sources can be explained by the change in Iran's product trade position of 230 kb/d and the higher domestic demand of some 80 kb/d. It is our general belief that Iran under the current Oil Minister is less inclined to violate OPEC agreements than ever before and that Iran is unlikely to risk internal and external criticism for the sake of an additional production of 300 kb/d. We detect a strong conviction on the part of Iran that they have been misunderstood and misinterpreted in this particular instance. This explains their reluctance to change their stance more than the potential revenue gains from 300kb/d at prices of under $10 per barrel!

Finally, is Iran really responsible for the low oil prices? While apparent OPEC discord for whatever reasons weakens the oil price, we think there are other factors behind the weak oil market than Iran, or for that matter, Venezuela. An additional 300-400 kb/d would not bring the price of oil down to these levels. *The problem is elsewhere.* In 1997, world oil demand grew by nearly 2 million b/d of which Asian demand growth was 639 kb/d or nearly one third. In 1998, Asian oil demand did not grow, but actually fell by 450 kb/d. The net change in Asian oil demand position was 1.1 million b/d although the Asian demand decline was actually quite small. The result was a drastic drop in global oil demand to only 600 kb/d for 1998. In other words, *in 1998, oil demand growth was 70 percent lower than the 1997 growth* (see Table 6). Another important factor affecting the price of oil is the significant decline in the cost of finding and developing new oil through technological breakthroughs as well as the return of international oil to the key oil producing countries. These are the real explanations behind the current lower oil prices.

Table 6
Global and Asian Oil Demand Growth
(thousand barrels per day)

	World Oil Demand Growth	Asian Oil Demand Growth
1997	1,980	639
1998	600	-450
1999	1,200	400

For 1999, we expect Asian oil demand to rise by 400kb/d and global oil demand growth to be twice as high as 1998, but still smaller than the 1997 growth. This should help keep WTI prices in the $13-15 per barrel range and help slightly increase the call on OPEC oil.

Special Membership Questionniare

Please complete both sides and mail to address on reverse

Structural shifts in energy markets imply that personnell who are nimble and adaptable with the appropriate skill sets will be the ones to prosper and bring the industry into the next millenium. To explore these skill sets Carol Dahl, Andre Plourde and Paul Stevens are putting together a session for the Rome IAEE meetings consisting of representatives of academia (or providers of energy economics education) and representative of government, industry and consulting industries who are demanders of energy economics education. To help us put together information for this session we would appreciate if you would give some thought to your current and future hiring needs and reply with answers to the following questions. Your opinions could be from your own educational experiences and as a new hire or from experiences with hiring new employees. We also invite you to attend the sessions and give us some feedback in person.

1. Rank the following knowledge, skill sets, and abilities that you would like new economics hires to have from 1 to 5 with 1 being unimportant and 5 being very important. If you have no opinion please leave blank.

Technical and analytical skills
- mathematical optimization tools_____
- econometric forecasting_____
- economic modeling_____
- negotiation skills_____
- computer skills_____
- energy finance_____
- ability to assess the effects of economic events on energy projects_____
- ability to do business across cultures_____
- marketing energy products_____
- economic fundamentals_____
- futures and options markets_____
- risk management_____
- economic analysis of environmental issues_____
- accounting_____

Personal skills
- leadership _____
- communication _____
- able to set priorities_____
- able to define and solve problems_____
- able to work in teams_____
- strategic thinking_____

Knowledge of:
- data sources_____
- national policy issues_____
- institutions in energy industries _____
- energy and resource legal framework_____

Other list and rank
- A. _____ _____
- B. _____ _____

2. Rank the following educational experiences in terms of how valuable you feel they are to future job performance and effectiveness with 1 being unimportant and 5 being very important. Please leave blank if you have no opinion.
   - international component_____
   - business internships_____
   - thesis_____
   - case studies_____
   - team projects_____
   - other - list and rank
   - A. _____ _____

B. _____ _____

3. Rank the following educational delivery mechanisms from 1 to 5 with 1 being unimportant and 5 being very important. Please leave blank if you have no opinion.
   long term degree programs emphasizing general skills_____
   short courses with specific focus_____
   short courses at your site taylored to your specific needs_____
   distance learning_____
   Other - list and rank
   A. _____ _____
   B. _____ _____
4. Rank whether the existing courses in each of the above categories are adequate for your current needs with 5 being adequate and 1 being totally inadequate. Please leave blank if you have no opinion.
   long term degree programs emphasizing general skills_____
   short courses with specific focus_____
   short course at your site taylored to your specific needs_____
   distance learning_____
   Other - list and rank
   A. _____ _____
   B. _____ _____
5. What essential skill set is most missing in new hires from economic and business programs?

6. What are the least useful skills that new hires have acquired in economics and business programs?

7. Please identify the type of organization to which you belong.
   government_____
   energy business_____
   energy consulting company_____
   international organization_____
   other_____
8. Add your name and contact information if you wish
   Name_____
   Address _____
   _____
   Phone_____
   Fax_____
   Email_____
9. Feel free to add other comments or information you wish us to consider.

Return to: CSM/IFP
Division of Economics and Business
Colorado School of Mines
Golden, CO 80403 USA
Email: cadahl@mines.edu

Fourth Annual Washington Energy Policy Conference

Western Hemisphere Energy Cooperation: The New Latin American Energy Market

Join experts from industry and government as they discuss the following:

- Overview and Policy Background (US-Latin America energy relationship, why is it so important and what are governments doing to nurture it?)
- Western Hemisphere Resource Review (Resource issues such as supply fundamentals, shifting supply sources)
- Clean Development Mechanism (Opportunities, impact on the hemisphere)
- Investments in Energy Infrastructure (experience of developers, future opportunities, problems)

Date: March 3, 1999
Place: Kenney Auditorium, The Johns Hopkins School of Advanced International Studies, 1740 Massachusetts Ave., NW, Washington, DC
Time: 9:00 a.m. to 5:00 p.m. with reception following (Registration begins at 8:30 a.m.)

Sponsored by:

- National Capitol Area Chapter, International Association for Energy Economics;
- International Energy and Environment Program, The Johns Hopkins School of Advanced International Studies;
- The Energy Council.

Registration fees (including coffee breaks, luncheon, and reception):

Member of the National Capitol Area Chapter, IAEE - $95.00
Those registered to attend the Energy Council's February 27-March 2 Federal Energy and Environmental Matters Conference - $95.00
Non-member - $125.00 (If you are not a member, you may join the National Capitol Area Chapter of the IAEE now and pay the member rate for registration plus 1999 dues of $20 for a total of $115.00.)
Full-time students will be admitted free if pre-registered. For student pre-registration, call 202-663-5786.

To register: Please return the form below with your check (payable to NCAC/IAEE) to Mr. David Vance, 6109 Eastview Street, Bethesda, MD 20817.

Here is my registration fee for the Washington Energy Policy Seminar on March 3, 1999.

NAME_____TITLE_____

COMPANY/ORGANIZATION_____

ADDRESS_____

PHONE_____EMAIL_____

CHECK AS APPROPROPRIATE:
NCAC/IAEE MEMBER_____ ATTENDING ENERGY COUNCIL CONFERENCE_____
NON-MEMBER_____
I WOULD LIKE TO JOIN THE NATIONAL CAPITOL AREA CHAPTER OF THE IAEE___

Another Fine Publication from the International Association for Energy Economics
Read What the Experts Have to Say in this New Special Edition of ***The Energy Journal***

DISTRIBUTED RESOURCES:

TOWARD A NEW PARADIGM OF THE ELECTRICITY BUSINESS

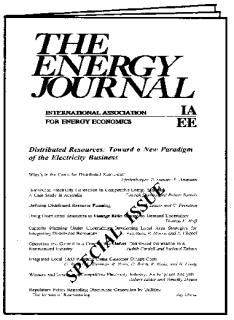
Edited by Adonis Yatchew and Yves Smeers

As electricity industries worldwide move toward restructuring, rationalization and increased competition, a variety of factors are combining to increase the prominence of distributed resource alternatives. These factors include: increased cost-effectiveness of small-scale generation; reduced confidence in long lead-time large-scale projects; increased pressure to find cost savings; changing regulatory relationships; new developments in technology; growing emphasis on environmental factors; and greater uncertainty about long-term load growth. This new special issue examines the emerging distributed resources paradigm. The DR paradigm promises to increase efficient use of resources by tailoring resource acquisition and rate design to local conditions. Several distinguished authors present their views in this concise, balanced and readable primer to the DR paradigm.

CONTENTS

This issue is co-sponsored by EPRI, one of America's oldest and largest research consortia with some 700 members.

ABOUT THE EDITORS: Dr. Adonis Yatchew is professor of economics at the University of Toronto, and joint editor of The Energy Journal. Professor Yves Smeers of the Catholic University of Louvain has been lecturing for 25 years, chiefly in Industrial Engineering, and has written over 50 major articles in this field. He has served as a consultant for international organizations and various energy companies in Belgium, Canada, France, Germany, Norway and the UK.



$75.00 US and Canada
$85.00 All Other Countries
250 Pages
ISSN 0195-6574

Authors include: P. Ammann, G. Ball, D. Birch, R. Bartels, J. Cardell, S. Chapel, R. Ethier, C. Feinstein, P. Hanser, T. Hoff, B. Horii, J. Lesser, H. Lively, D. Lloyd-Zannetti, P. Morris, J. Morse, T. Mount, J. Pfeifenberger, R. Ricks, D. Sharma, R. Tabors.

To order fill out the form below and mail to the IAEE.

This special edition will be useful for electric utilities and planners as well as, economists, and anyone engaged in the practice or analysis of the electricity business, environmental issues and public policy.

Visit the IAEE homepage on the World Wide Web: http://www.iaee.org.

ORDER FORM – Special Issue from the IAEE

DISTRIBUTED RESOURCES: Toward a New Paradigm of the Electricity Business

Please send me _____ issues of "Distributed Resources"

$75.00 each U.S. and Canada shipments (includes postage and handling) $85.00 All Other Countries (includes postage and handling)

_____ Total enclosed. Make check payable to IAEE in U.S. dollars with checks drawn on a U.S. bank.

Name: _____

Title: _____

Company: _____

Address: _____

City, State, Mail Code: _____

Country: _____

Send order form along with payment to: **International Association for Energy Economics, 28790 Chagrin Blvd., Suite 350, Cleveland, OH 44122 USA**

Phone: 216-464-5365 - Fax: 216-464-2737 - E-mail: iaee@iaee.org - Website: www.iaee.org

A Nuclear Energy Tale

*By Ferdinand E. Banks**

Every year, in conjunction with the awarding of the Nobel prizes, the new laureates participate in a TV program called *Snillen Specularer* (Genius Speculates), where they discuss various topics that are supposedly of interest to a broad audience.

The dominant voice this year was the physics winner, Robert Laughlin, who at one stage of the discussion expressed outrage that in Sweden scientists who receive their paychecks from the government are encouraged to avoid discussing nuclear matters in a serious (i.e., technical) fashion, just as they are prevented by law from participating in organized nuclear research. Of course, if they had conclusive proof in one form or another of the economic shortcomings of nuclear energy, then it is likely that they would be warmly welcomed to the corridors and restaurants of governmental power. However, as many of us know, such proof is difficult to come by; some would say impossible.

The Social Democratic governments in both Sweden and Germany have now announced that they intend to dismantle their nuclear sectors, although they are deliberately vague about the time frame. In both countries this departure is the work of the small but vocally active environmentalist parties; it is a part of the price that must be paid by the Social Democrats for the political cooperation of these parties. Personally, I consider arrangements of this nature a dangerous threat to rational governance, and eventually to democracy itself, but I see no reason to broach that topic at the present time. Instead, I would like to discuss several economic aspects of the nuclear retreat.

Sweden and Norway are generally credited with having the most inexpensive electricity in the world; but Norway's electricity is about 95 percent hydro based, while Sweden's is approximately 46 percent nuclear based. This give the thoughtful observer some idea of what *best practice* nuclear installations are capable of. The simple conclusion that needs to be drawn here is that there is no quantitatively comparable source of electricity in the world that can match–on a cost basis– the electricity that can be produced in the Swedish nuclear sector.

According to an article in *Le Point* (Pour ou contre le nucleaire: un match en huit rounds, 14 November, 1998), the average cost of nuclear power in France is 21 centimes/kWh, while the cost of gas is 19-28 centimes, and 22-26 centimes for coal. (In Sweden the cost of nuclear would be about 17-19 centimes/kWh, while the cost of gas and coal would be about the same as in France). As pointed out in the same article, the cost for nuclear applies to an installation with a power rating of 1400 MW, while gas and coal have the above listed costs for units rated as 650 MW. What this means is that if electricity demand has stagnated, then newly constructed nuclear plants will not be able to produce at or close to the minium point on their average cost curves for many years, and thus, considered over the lifetimes of these facilities, gas and coal are more economical in new installations.

But this argument does not have universal application. It does not apply to those developing countries where there are already gigantic power shortages. China is a good example. It may not apply to the new Central European *transition* economies; and it would not apply to France and Scandinavia if the Germans are serious about massacring their nuclear sector. As reported in the *Financial Times* (Friday, December 18, 1998), "The French are probably laughing all the way to the bank – literally. They will be able to run their (nuclear) plants a lot harder. In fact this is true for all countries surrounding Germany – they are definitely rubbing their hands with glee."

A comment might be useful at this point. The price of electricity in Germany is almost twice that in Sweden, and much larger than in France. A *liberalised* Europe in which Sweden and France can freely export electricity to Germany would mean that 1400 MW installations in France – if they are comparable in load/capacity factors to nuclear equipment in Sweden and Finland – will be able to out compete with natural gas and coal facilities of any size in Germany.

There is also some hand rubbing taking place in Sweden. Perhaps the main impetus for electricity deregulation in Sweden is the thought of access to the electricity markets of the countries comprising the *Baltic Ring*, to include Northern Germany. In fact, one of the reasons for the Swedish power industry's tame acceptance of the unreasonable arguments for scrapping their nuclear capacity is their belief that electricity generated in any kind of Swedish installation will be competitive in Germany. Similarly, an important reason for the docile acceptance by German households of nuclear disengagement is the present high cost of German electricity. It is a relatively simple matter for the *Greens* in that country (and in Denmark) to sell the myth of inherently inexpensive *green electricity*. Swedish consumers know better, even if their knowledge has not done them any good.

At the present time in Sweden, a glib argument is being forwarded that nuclear energy is just a "parenthesis" in world energy history, although I prefer to believe that the real nuclear age has not begun. Regardless of what we think about the availability of fossil fuels at the present time, in 50 years these resources might be drastically depleted (and that may include high quality coal). On the other hand, world population may have reached 10 million persons. In these circumstances, it would be foolhardy to ignore the energy in uranium.

One final observation. Although a consensus of physicists claims that the storage of nuclear waste is a problem that has been solved, they do not have much good news to give us where the issue of atmospheric deterioration due to the production of carbon dioxide (CO_2) is concerned. When my own thinking is in a neoclassical mode, it tells me that in a textbook world the nuclear sector in countries like Sweden should be expanded rather than contracted – since nuclear installations produce no CO_2 directly – and the cost savings (in relation to gas, coal, and renewables) would be used to support research and development of the alternative energy technology that figures so prominently in the future economic scenarios that the environmentalists have constructed for the industrial world. Scenarios that, if taken verbatim, are largely naive and counterproductive; and which, if realized in detail, represent a clear and perhaps not so remote danger.

References

Banks, Ferdinand E. (1999), *Energy Economics: A Modern Introduction*. Kluwer Academic Publishers, Amsterdam and New York.

Rose, Johanna (1998), "Nya Krafter", *Forskning och Framsteg*, No. 6 (September).

*Ferdinand E. Banks is a professor at the University of Uppsala, Uppsala, Sweden.

British Institute of Energy Economics

The 1999 BIEE Conference

St John's College, Oxford - September 20th and 21st 1999

"A New Era for Energy? Price signals, industry structures and environment"

Planning for the 1999 Conference is underway with a new venue at St John's College, Oxford University on Monday and Tuesday 20th and 21st September 1999.

The conference will focus on the interplay of competitive market forces, social and environmental concerns and technological change, that is driving the energy business towards a new era. The new era seems likely to be characterised by low prices yet pressures to constrain energy use for environmental reasons. At the same time there is rapid structural change in most energy industries as markets liberalise and become more competitive. All this raises complex problems and challenges both for industry, policy-makers and regulators. The conference will bring together, from the UK and elsewhere, university economists and others with specialisms in energy issues, postgraduate students and also economists and policy-makers working on energy issues in industry, government and related organisations.

CALL FOR PAPERS

Papers will be welcome on the following (or related) themes:

- energy prices and energy demand: how does energy use evolve in an era of apparently low energy prices?
- with what instruments can Governments, especially in the UK and EU, respond to simultaneous pressures for low prices / efficient energy use / high environmental protection? What will be the economic impact of these measures?
- what are the sources and consequences of structural change in the energy business?
- what strategies can energy companies adopt to cope with the new era? What are the environmental and technological impacts of these strategies?
- what will be the impact of the growing integration of UK and EU energy markets?
- what do low prices and competitive pressures mean for (a) investment behaviour and/or (b) technology development in energy? and/or (c) use of future markets and financial instruments?
- what are the economic impacts of the various 'flexibility mechanisms' (trading, clean development mechanism etc.) envisaged at Kyoto?

It is intended that, as with previous conferences (*The UK Energy Experience: A Model or Warning?* and *The International Energy Experience)* papers presented at this conference will be able to be considered for inclusion in an edited volume from a major publisher. *Deadline for Submission of Abstracts: April 30th, 1999 (200 to 1000 word*s).

Please indicate intention to present a paper and submit extracts or willingness to organise a session/ speak as soon as possible (at latest by end April 99) to one of the organising committee:

Gordon MacKerron (SPRU, Sussex Univ)	gmackerron@mistral.co.uk	01273 686758
Peter Pearson (Imperial College, London))	p.j.pearson@ic.ac.uk	0171 594 9298
Andrew Barton (BP)	bartonap@bp.com	0171 496 4387
Paul Horsnell (Oxford Institute)	paul.horsnell@lincoln.ox.ac.uk	01865 311377
Mary Scanlan (Secretary of BIEE)	mailbox@biee.demon.co.uk	0181 997 3707

See Page 27 for Registration Details

Gradium Solar Cells: Now Less Is More

*By Barbara M. Wolcott**

For every lunar landing, Mars explorer or Galileo space probe there is a corollary benefit on terra firma, from instant communication to clean power generation. It is also worth recognizing that one singular scientific advance has had a major part in the benefits of space explorations: Mighty mite solar cells that in space take a licking and just keep on ticking.

Solar cell technology has an important role in the National Aeronautics and Space Administration's Performance Plan for 1999 and beyond, where they pledge a "faster, better, cheaper" approach to reduce spacecraft development time and costs. That same technology has a growing place in the commercial market here on the ground with flat plate banks of cells providing primary power for households and backup power for the communication business.

However, until recently solar power has had an image problem. Not only is it believed to be expensive compared with available electricity from traditional sources, the panels are troublesome to set and in some cases, ugly. In thirty-nine states across the country, condominium associations have banned solar panels from their buildings in spite of the growing need for clean power. Enter the new generation: Solar power is now beautiful and affordable, especially in view of dramatic changes in utility company billing systems.

In northern California, the Sacramento Municipal Utility District (SMUD) is already on board because of explosive population growth in its area. SMUD is the smallest utility in California, but the fifth largest publicly owned electric utility in the United States in terms of customers served. SMUD has had to address both distribution and production issues that do not face other utilities because older companies already have poles widely installed. Power generation costs are about half that of putting in transmission lines, and looking at a cost of running new lines in the neighborhood of $1 million a mile—and running power to an industrial site significantly more—SMUD looked seriously at alternative power to reduce capital costs. They polled their customers to ask if they were interested in green energy. The answer was emphatically yes, and in 1993, SMUD embarked on a solar roof program called the PV Pioneer Program.

SMUD installs PV roofing on volunteer customers' homes, retains ownership and maintenance of the solar system and participants pay the same as their average electric bill plus a small surcharge. Four hundred fifty homes already have the solar roofs and another 100 will be installed each year for the next five years. There are more volunteers for the roof installations than can be accommodated immediately.

The program has been so successful that SMUD has embarked on a second phase of the project where homeowners may purchase the systems outright. Until recently the cost of an individual home installation in the open market has been about $18,000, but SMUD customers can purchase a complete system, including net metering, for $4,460 on a ten year contract at 9.5 percent, or with their own financial resources. Just over half the actual cost is subsidized by SMUD.

SMUD has a history of using alternative energy and has solar cells running new power substations, in addition to maintaining the ten year old PV power plant at Rancho Seco. The roof-top power plants are enabling the utility to put off the construction of additional power plants, as well as help meet power demand at peak hours of 11 am to 2 pm which are the same hours the PV roofs are producing excess power.

The new solar technology is so promising that British Petroleum has committed significant production volume to the cells. With manufacturing plants in six countries, including one in Fairfield, California, BP is the world leader in affordable solar technology. The cost of solar cells is now one-seventh of what they were in 1980 due to improved manufacturing methods and increased market demand. BP Solar expects sales will increase to $1 billion in the next decade. This movement is only a few years old in the United States, but with very aggressive marketing for the last 15 years in other countries, it is much more commonly used in Europe and Japan.

The bulky, unsightly panels are gone and in their place are sleek roofing tiles, not unlike slate or asphalt, into which solar cell crystals are hermetically sealed. The new PV cells used in roofing material are made from amorphous silicon, which is melted, then poured onto a substrate and let to solidify just like a window pane, instead of growing the crystals, then slicing them as has been the case with earlier versions. Crystals in older cell technology are oriented in the same direction to be active when exposed to sunlight, but the far less costly amorphous silicon has microscopic orientations in many directions. A large percentage of them are not used at all, so the cell is scanned during manufacture to identify which ones are not oriented usefully and then blown away with a laser. The result is similar to a piece of Swiss cheese, with microscopic holes, making the wafer look transparent at a distance, but a solid when viewed up close.

In the roofing tile, each cell is connected with fine metal ribbons, attached to a one foot by two foot concrete/fiber backplate that is sprayed with metal to create a conductive surface. The result is a roof tile that is approximately the same thickness as conventional asphalt roofing. The tempered glass tiles have been documented to withstand temperatures ranging from minus 23° to 166° Fahrenheit, and winds in excess of 125 mph. The modules are classed as A roofing material in Los Angeles County, California and Dade County, Florida which means that the material is the best, of the longest lasting quality. PV power stands head and shoulders above other energy producers, especially in comparison to facilities like Diablo Canyon. PV energy is extremely simple and clean, has no moving parts, needs no support facilities, and it has no toxic by-products to conflict with the environment. Basically, you take a cell and expose it to sunlight. The only environmental impact is in the manufacture, which is minimal.

SMUD produces PV energy in banks of cells on covers for parking areas, and in a region that commonly has summer temperatures in triple digits, that is a public relations coup. In a few short years, SMUD has become the largest distributor of PV generated power in the world.

As encouraging as this news is to solar power enthusiasts, solar cells are poised to take another giant leap forward, and LightPath Technology's Gradium lenses will be in the vanguard.

---

*Barbara M. Wolcott is an independent, freelance writer specializing in technology, people and travel located in San Luis Obispo, CA.

Two years ago, the U.S. Air Force Space Vehicles Directorate called for research bids for advanced photovoltaic cells that were ultimately developed and delivered by LightPath Technology. LightPath had been researching the photovoltaic concentrator lens system with a fifty percent increase in power and a major decrease in size for about twelve years. LightPath's optical lens products have wide ranging potential uses from imaging and laser optics with its ability to bend light and separate colors, to dividing multiple wavelengths for fiber optics WDM (wavelength division multiplexing) applications. The unique glass can be pre-programmed like a microchip to make the glass bend and curve light to accomplish certain effects with light.

For space technology, the solar concentrators provide much higher functionality because they produce power even when not pointed exactly at the sun. If the sun hits the cell at 10° off the perpendicular, it is able to bring the light into the glass and funnel it down to the photovoltaic cell. Even 2° makes a substantial difference for the present flat plate cells now in use, and the new technology allows satellite manufacturers to relax tolerances to meet the sun perpendicularly for continuous power—a major improvement that saves hydrazine fuel onboard used to redirect satellites toward the sun.

LightPath's Gradium lenses are able to reduce the satellite module weight by 50 percent and the square footage of the panels by 20 percent, which results in decreased launch costs or increased room for payloads. The lenses also allow the launch of more powerful data transmitters which in turn reduces the size and cost of Earth stations. With space power not dependent on exact perpendicular status with the sun, the amount of hydrazine fuel in satellites will be better utilized to prolong the life of the satellite itself.

The Deep Space 1 mission, launched on October 24 of last year is the first test of the solar cell concentrators, but of more interest to the earth-bound, LightPath is working to adapt the technology to solar arrays for use on the ground or on roofs. At present the cost is significantly higher for the new solar power arrays, but as commercial deployment increases, the corresponding costs will fall.

Lead-free Gradium glass is unique in that it is the only material that can direct light internally, collect and concentrate energy, and separate wave-lengths for high-speed data. The technology has the capability to reduce effective costs ten times or more for satellite systems without a reduction in PV power production. Their efficiency rate is 30-32 percent in light to energy ratios, compared with 17-24 percent with non-Gradium concentrators.

The Gradium concentrators could have an enormous impact on communications for telephone, video, television and cable transmission. At present, there are about 250 Geostationary (GEO) and about 100 Low Earth Orbit (LEO) satellites operating in orbit. By 1999 those numbers will climb to 300 and 340, respectively. By 2005, it is expected that 1,600 satellites will be orbiting Earth.

Following the extraordinarily successful Phase 2 test of Gradium solar concentrators at the Air Force Research Lab in Albuquerque, Air Force officials were impressed enough to help LightPath make a rapid technology transfer to the commercial satellite market. Gradium is giving solar cell technology a giant leap forward to compete in the open market for a share of the power industry. Future advances are likely to push the technology ahead of any other source of power generation.

In California power companies have two years to retire their uncapitalized debts in the wake of sweeping reform. After that time, all indications point to significant rate increases despite the competitive nature of power purchase, transmission and delivery. It may be that only the owners of roof tile solar power systems are smiling at that prospect. Chances are that few of them will fully appreciate that their personal solar power production is a reality because photovoltaic solar cells have been, and will continue to be, the workhorses of space exploration.

1999 Directory

The 1999 Membership Directory will be published early in May. Members are urged to ensure that the information Headquarters has in its database is up-to-date.

Directory Information Forms have been mailed to all affiliate leaders with instructions to forward them to all members for updating. If affiliate members have not received these forms they should contact their affiliate leader promptly.

Direct members receive Directory Information Forms with their annual dues renewal notice.

Directory Information Forms must be received by the end of March to have the information included in the May Directory. Changes in member information may be sent to Headquarters at any time.

Conference Proceedings
21st IAEE International Conference
Quebec, Canada May 13-16, 1998

The Proceedings from the 21st International Conference of the IAEE held in Quebec, Canada, are now available from IAEE Headquarters. Entitled *Experimenting with Freer Markets: Lessons from the Last 20 Years and Prospects for the Future*, the proceedings are available to members for $89.95 and to nonmembers for $99.95 (includes postage). Payment must be made in U.S. dollars with checks drawn on U.S. banks. To order copies, please complete the form below and mail together with your check to: Order Department, IAEE Headquarters, 28790 Chagrin Blvd., Suite 350 Cleveland, OH 44122, USA

Name _____

Address _____

City, State, Mail Code and Country _____

Please send me ____ copies @ $89.95 each (member rate) $99.95 each (nonmember rate).

Total enclosed $_____ Check must be in U.S. dollars and drawn on a U.S. bank, payable to IAEE.

Crude Oil:
A Call for Enlightened Price Management

*By William R. Edwards**

Crude oil prices: is there any logic to explain the erratic nature of the recent price swings? Of the apparent lack of connection between oil prices and industry fundamentals? Is the price of crude oil at an economically sound or justifiable level? Is there anything that can be done to correct the unsatisfactory prices? These are questions that need to be answered, but more importantly they need to be understood.

To begin to understand the price puzzle, we must first identify and examine the role of each of the major players:

- Crude oil producers
- The members of OPEC, who are a special group of producers
- The New York Mercantile Exchange

The role of the first group, the oil producers, is generally one of dependency. Most producers are dependent upon the actions of others. If OPEC gets a cold, the rest of the producers get the flu. The role of the second group, OPEC, is of key importance in oil pricing. In actual practice, their actions determine the course of oil prices. So before we get to the third group, we need to amplify upon some of the characteristics and tendencies demonstrated by most producers.

Generally oil producers take a very one-sided view of oil prices. Although there are two sides to pricing, cause and effect, producers commonly concern themselves solely with the *effect*, leaving the *cause* to be handled by others or "the free market."

In the case of petroleum pricing, a complete misunderstanding of cause and effect has brought about the inability to stabilize prices. Most people in the industry believe that high prices are caused by underproduction. In the same way they believe that low prices are caused by overproduction. *As logical as this sounds, it is not true. As widely believed as it is, it is still not true.*

There are two more universally-accepted beliefs within the petroleum industry, which are actually incorrect:

- Production levels control price.
- There is an instantaneous relationship between price and demand.

These two misconceptions are the foundation for the instability and unreasonably low levels of petroleum prices that have prevailed for the last thirteen years. The application of these misunderstood factors has caused attempts at price stabilization to fail.

It is generally believed that OPEC determines production levels and that production levels determine prices. Based upon this inaccurate perception, OPEC's member countries spend their time and energies trying to implement production quotas which they hope will produce the desired price effect. The problem is that their premise – the assumption that they control production levels – is incorrect. Naturally all actions built upon this false premise will be ineffective.

OPEC can no more control production levels than your corner service station can control its gasoline sales. Both entities, the OPEC producers and your local gasoline retailer, are in the position of pumping oil into whatever tanks the customer brings to the pump. Therefore, the customer, not the supplier, determines production levels. The assertion that OPEC overproduces is an impossibility. Customers can overbuy, to the extent that they have empty tanks to pump the oil into, *but OPEC cannot overproduce.*

In the existing global system, OPEC and its member countries determine oil price levels. This is not to say that the price levels are where OPEC wishes them to be. Quite the contrary. Prices are much lower than they would choose. But their decisions and their actions set the price of crude oil, whether it be the roller-coaster prices of the recent past or the relatively stable prices of the 1982 to 1985 time period.

This raises the question, if OPEC's decisions and actions determine prices, how can it be that prices are not what they wish them to be? One major reason is that they are allowing prices to be determined by *the futures market.*

This brings us to the role of the third group, the New York Mercantile Exchange. This group's role is probably the one that is most misunderstood. The general perception is that the Nymex reflects the free market in action and the prices reported for oil futures represents the ultimate in transparent free market oil prices. It is further believed that the prices emanating from the oil futures trading floor are the result of fundamental factors at work in the oil supply system.

The very existence of oil futures is justified on the basis that it provides a hedging mechanism for oil producers and customers. While true hedging can occur in theory, and even in practice to a very limited extent, the nature of this activity cannot be used effectively in any large volume hedging because the futures market is just too small to handle much of the business. The fact that it is too small is revealed whenever some company decides to use the futures market for true hedging in a significant magnitude. The disaster at Metalgeschellshaft in their oil futures activity is one example. The actions of a large U.S. gas company in the gas futures market more recently is another example. While the number of transactions in the futures markets is high, the quantity of oil or gas involved, stated as "open interest", is very low.

While it is common for there to be 100,000 trades on the futures market in a single day, the amount of oil which could be delivered based on the *maximum* open interest for a year would amount to only 500 MB/D, or about 0.5% of worldwide production. Again, that's *maximum*. The actual quantity, based on historical figures of oil delivered through the Nymex, is less than 0.01 percent of worldwide production. Therefore, the role of futures in actual hedging is insignificant.

The role of futures in *setting* oil prices, however, is not insignificant. In fact, the futures price in the current world actually becomes the oil price. And while this sounds contradictory to the earlier statement that OPEC's actions determine oil prices, both statements are true since OPEC's current action is to adopt the futures price as their selling price. Were they to choose another indicator to set their price, the Nymex prices would no longer become the price of oil. Unfortunately, OPEC persists in allowing Nymex prices to determine the price of oil, to the detriment of the industry.

Futures prices for any commodity are erratic. Oil futures are no different. The underlying cause of the volatile nature of futures prices is a combination of substantial leverage and

* William R. Edwards is president of Edwards Energy Consultants, Houston, Texas.

instantaneous financial accountability. When money is due, you have to pay or get "blown out". Getting "blown out" means buying or selling at any price you can get at the moment. No opportunity to "work things out". It's like having a call on your bank note and having to put up or fold up right now!

Putting it another way, every day is crunch day. Buying and selling decisions in the futures market are not made on the basis of considered judgment of what prices should be. The decisions are usually based on what one can get at the moment, usually from a futures professional who is skilled at taking advantage of the panicked, non-professional buyer or seller.

I have just described the psychology surrounding oil futures trading. This is a key element in understanding the wild swings we see in the futures market. But we need also to appreciate the distinct difference between the futures "free market" and the real oil "free market". This will help us understand why the futures market can never be representative of the real oil world fundamentals *and should never be the basis for oil prices*.

Unlike the real world of oil, oil futures have no supply/demand constraints. Supply and demand are completely elastic. Since the futures market is dealing with paper, IOUs, or whatever description you wish to give them, you can create as many as you wish as long as you have two people willing to take opposite sides of the speculation. There can be a constraint on the number of available buyers or available sellers, but the constraint has nothing to do with the supply/demand relationship of real oil. The tank can be almost full, but if the professional paper traders are inclined to take a "buy" position, futures prices will rise, regardless of the real oil inventory. The reasons why the 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. The position they take is based on who is in a crunch and who is ripe for victimization. Futures traders do not care what level their trades take place. They do not care whether prices go up or down. They only care that they move. They can take advantage of the "suckers" or novices in either or both directions.

Remember that futures prices are the free market price of IOUs, not oil! This should clear up the question as to why there is no correlation between futures prices, which are oil prices only by adoption, and the supply/demand fundamentals for oil or gas. The realization of this fact makes it obvious why futures prices should not be used to guide the real oil world.

A study of the history of crude oil prices is necessary to underscore what has been suggested above. Chart 1 details the history of crude oil price, as expressed by the West Texas Intermediate futures price, over the past fifteen years. We are justified in using futures prices inasmuch as the industry currently uses these numbers as their prices. The first thing we notice is that prices during the first three years of the period, 1983 through 1985, were much higher than has been the case ever since. The chart reveals that during the past twelve years prices have moved in a roller-coaster pattern with more than a 100 percent difference between the lows and the highs. Except for a short period during the Iraq/Kuwait/UN conflict, prices never again reached the levels enjoyed during the early eighties. This provides sufficient proof for the conclusion that prices do not follow OPEC's wishes.

Chart 1
West Texas Crude Price

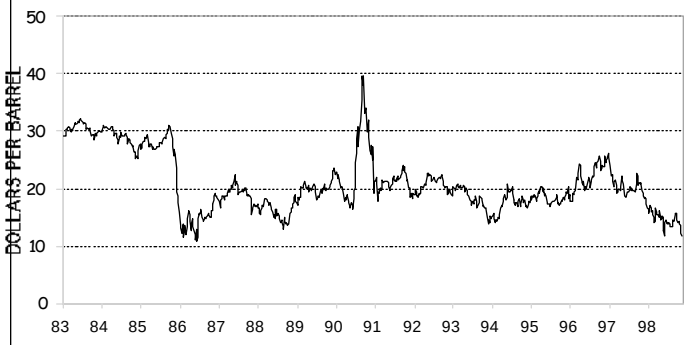
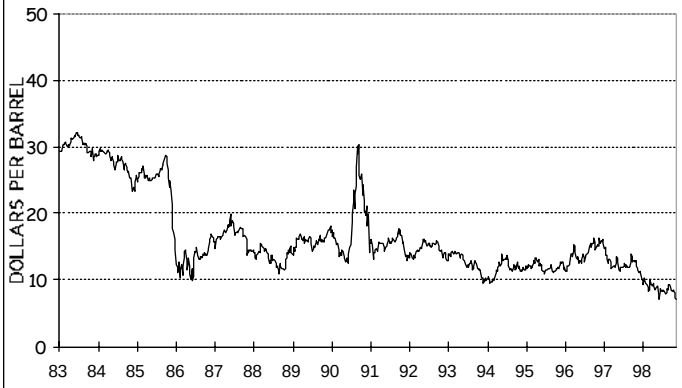


Chart 2
Crude Price in 1983 Dollars



Let us next examine price levels from a fundamental standpoint to gauge the appropriateness of the current price levels. The prices shown on the Cart 1 were expressed in "dollars of the day". For comparison, Chart 2 shows the price expressed in constant dollars. This is a better measure of real purchasing power as inflation has been factored out. As can be seen, the purchasing power of prices received in 1985 were four times that which current crude oil prices generate. It is important to observe that the world economy and the oil industry were functioning smoothly *with these prices* at the time. Therefore, it is appropriate to conclude that there is no justification for disposing of such a valuable, irreplaceable resource for such meager compensation as current pricing provides.

It is worthwhile at this point to discuss an oversimplification that frequently occurs when considering prices. This oversimplification presumes that the word "price" is all inclusive, particularly when we identify it as "the free market price". Let me suggest that there exist at least two distinctly different types of prices: "whimsical prices" and "enlightened prices".

"Whimsical prices" are what you see reported as "The Price". In the case of petroleum, this whimsical but popular price is taken from futures trading and is usually thought of as "the free market price". The definition of whimsical, "erratic in behavior or degree of unpredictability"[1], applies perfectly to the recent history of oil prices. While popular and universally accepted, the futures-based price has no relationship to a fundamentally sound price or what I call the

(continued on page 26

Crude Oil:.... *(continued from page 25)*

"enlightened price". Arriving at an enlightened price requires some assessment of the nature of the commodity, its cost and availability, and the corresponding demand curve for the product. An enlightened price is more reflective of the true value of the commodity. Obviously, this enlightened price is much more difficult to ascertain than the whimsical price. The difficulty of determining this price and the lack of recognition that it exists are the two main reasons why an enlightened price is not applied to crude oil.

It seems obvious that crude oil price management needs to be drastically restructured so that prices of oil reflect more nearly its true value. In the words of the popular culture, crude oil price management needs to be "reinvented".

There is one additional aspect of the oil price outlook that we should consider. Environmentalists are pushing for a reduction in fossil fuel use. The oil industry has attempted to apply reason and intelligence to the subject. The rest of the world is more inclined to proceed on the basis of emotion and preconceived notions, and they represent the majority. Therefore, they will prevail in this contest. We should accept the inevitability of some sort of oil use reduction in the future and devise an effective strategy for capitalizing upon this event.

In summary, oil prices today follow an erratic, variable path that is not justified by petroleum fundamentals. Neither is it the result of intelligent consideration and guidance. Current oil prices are merely adopted futures prices. OPEC has the inherent power as well as the responsibility to provide effective price leadership. Therefore, OPEC should adopt a revised approach, one of enlightened price management that will incorporate stability and reason into oil prices as we enter the challenges of the next century.

[1] *The American Heritage® Dictionary of the English Language, Third Edition* copyright © 1992 by Houghton Mifflin Company. Electronic version licensed from INSO Corporation. All rights reserved.

Special Issue of *The Energy Journal* Planned on Analyses of Kyoto Protocol

During 1998 the Energy Modeling Forum at Stanford University has been coordinating a set of standardized comparisons of the energy-economic consequences of various implementations of the Kyoto protocol on climate change policy. Thirteen modeling teams have participated in this work. A special issue of *The Energy Journal* is planned which will consist of a paper by each modeling team describing key insights obtained from its analysis of the standardized scenarios, as well as from analyzing other relevant scenarios. Also included will be an introductory chapter laying out the study design and comparing model results for four core scenarios. The wide variety of model structures will provide a rich set of model comparisons and policy insights.

The special issue will be edited by John Weyant, EMF Director and coordinator of the study. He will be assisted by the other members of the study design – Henry Jacoby of MIT, Jae Edmonds of Batelle Northwest National Laboratory and Richard Richels of EPRI.

Publication is planned for early this year.

The British Are Coming! The British Are Coming!

*By Fereidoon P. Sioshansi**

For some time, the UK power companies have been trying to buy into the United States market, but without success. But it was bound to happen, and in December two big deals were announced. The first was Scottish Power PLC buying Portland, OR-based PacifiCorp for $7.04 billion. Before the analysts could digest the news, it was announced that the National Grid Company (NGC) was buying a New England distribution company, the New England Electric System (NEES) for $3.2 billion. The latter was more of a surprise, since it is the takeover of a regulated U.S. distribution utility by what is essentially a for-profit ISO in England and Wales.

As is usually the case, skeptics on both side of the Atlantic were scratching their heads, trying to make sense out of these latest two mergers, both acquired at a significant price premium. The acquiring companies, of course, were doing their part to explain why it was such a good deal. Others were speculating that this is merely the tip of the iceberg, that many more cash-rich foreign utilities will be buying into the U.S.utility sector in 1999. *The Wall Street Journal* (8 December 1998), for example, heralded the start of a U.S. utility invasion and speculated who the next invaders may be.

Who May Be Next?
Global Utilities with Big Cash Chests

Company	Equity Market Value ($B)
Tokyo Electric Power (Japan)	$33
Suez Lyonnaise des Eaux (France)	$29
VEBA (Germany)	$26
Endesa (Spain)	$26
RWE (Germany)	$25
Duke Energy (US)	$22
Southern (US)	$21
Electrabel (Belgium)	$20
Kansai Electric Power (Japan)	$20
Iberdrola (Spain)	$15
Tractebel (Belgium)	$14
Texas Utilities (US)	$13
National Grid (UK)	$12
Electricite de France (France)	Govt Owned

SOURCE: *The Wall Street Journal*, 8 Dec 1998, Goldman Sachs & Co.

The problem facing foreign investors in the U.S. utility market is no different than those the U.S. utilities endured when they went to the UK and Australia in search of golden investment opportunities. The first of many obstacles, even assuming speedy regulatory approval, is merging two different management cultures and organizations.

Second, the challenge of understanding and mastering a foreign business environment that inevitably looks more promising from across the ocean. In the case of NGC and NEES, for example, these two issues are expected to prove problematic. Finally is the matter of price premium paid in the haste and excitement of getting the deal done. Both of the two recent British acquisitions carried a price premium believed to be excessive by many financial analysts. Despite, these misgivings, many more will undoubtedly try.

* Fereidoon "Perry" Sioshansi is a Partner with Convector Consulting Inc. in Menlo Park, CA. He edits and publishes the *EEnergy Informer*, a monthly newsletter. This is an edited version of an article which appeared in the January 1999 issue and is available on the web at http://members.aol.com/eeinformer

British Institute of Energy Economics

THE 1999 BIEE CONFERENCE

St John's College, Oxford

September 20th and 21st 1999

A New Era for Energy? Price Signals, Industry Structures and Environment

Plenary Speakers:

Professor Peter Davies, BP Amoco — Dr. Dieter Helm, OXERA

Robert Mabro, Oxford Institute for Energy Studies — Gordon MacKerron, SPRU

The conference will focus on the interplay of competitive market forces, social and environmental concerns and technological change, that is driving the energy business towards a new era. The new era seems likely to be characterised by low prices yet pressures to constrain energy use for environmental reasons. At the same time there is rapid structural change in most energy industries as markets liberalise and become more competitive. All this raises complex problems and challenges both for industry, policy-makers and regulators.

The conference will bring together, from the UK and elsewhere, university economists and others with specialisms in energy issues, postgraduate students and also economists and policy-makers working on energy issues in industry, government and related organisations.

As well as the plenary sessions, the conference will split into parallel sessions. Each parallel session will have papers presented on a particular topic followed by discussion and questions. A conference pack will be sent to participants a few weeks in advance of the conference, detailing the agenda, and arrangements. *Early registration is advised with numbers strictly limited to 200.*

Suggested topics of the sessions include:

- energy prices and energy demand
- energy regulation and taxation
- structural change in the energy business
- strategies of energy companies in the new era
- growing integration of UK and EU energy markets
- the economic impacts of the various 'flexibility mechanisms' (trading, clean development mechanism, etc.) envisaged at Kyoto
- other sessions relating to the theme will be arranged according to the papers offered.

As with previous conferences (*The UK Energy Experience: A Model or Warning?* and *The International Energy Experience)* papers presented at the conference will be selected for an edited volume from a major publisher available at additional cost after the conference.

The conference will start at 12pm on Monday 20th September 1999 and will close at 4pm on Tuesday 21st September.

Meals and accommodation at St John's College, Oxford are included in the conference fee. **There will be a conference dinner and reception on Monday 20th September in the College dining room followed by an after dinner speech by Robert Mabro.**

The conference fee **is £220 including VAT ($US 365 / Euro 315) for BIEE and IAEE members. For non-members, the fee is £240 including VAT ($US 400 / Euro 345).**

(A concessionary rate is available to academics, students and pensioners at a rate of £140 [$US 230 / Euro 200])

*****See Page 21 for Call for Papers Details*****

Registration:

Title(Mr/Mrs/Ms/Miss/Other) _____ **Family/Surname** _____

Forename _____ **Job Title** _____

University/Company/Organisation _____

Address _____

Post Code _____ **Country** _____ **Tel No** _____

Fax _____ **E Mail** _____

Preferred method of payment is by cheque payable to "BIEE" in sterling/dollars/euros to:

Mrs Mary Scanlan (Administration Secretary BIEE)

37 Woodville Gardens — **Tel No: 0181 997 3707**

LONDON W5 2LL, United Kingdom — **Fax No:0181 566 7674**

Does Competition *Inevitably* Lead to Lower Prices?

*By Fereidoon P. Sioshansi**

The popular belief is that competition will *inevitably*—and *automatically*—lead to lower electricity prices. The reality is never that simple, nor equivocal. True, competition *generally* leads to improved efficiencies in operations (e.g., power generation), cost reductions in certain functions, the introduction of new—and sometimes improved—services. But its impact on electricity prices is more complicated for several reasons:

- **Large vs. small customers**. The intense pressures to cater to certain large and strategically important customers tends to lead to lower prices and/or offering customized services at little or no cost. Conversely, many small and marginally profitable customers may experience little or no price reductions, end up paying higher prices, and/or suffer service quality degradations. It makes perfect business sense to look after the big customers, but is political suicide. Neither the politicians nor the utility regulators savor the thought of newspaper headlines claiming that residential customers are paying higher bills so the fat industrials can get a break. But that, in a sense, is part of the reality of competitive markets. Larger customers with their high load factors and high-voltage service levels are cheap to serve.
- **Cost attribution and price rationalization**. Another factor further complicating a meaningful comparison of *pre-* and *post*-competition prices is the disappearance of many subtle price subsidies among and across customer classes. Cost allocation and price adjustments, which are a highly important and necessary by-products of industry restructuring, tend to result in significant cost shifts across internal functions and among customer classes. Consequently, some prices rise while others decline even in the absence of any net cost reductions.
- **Risk and return**. The introduction of competition to monopoly functions (e.g., power generation and competitive energy supply) introduces certain risks not previously present. This, in turn, requires higher returns on investment to attract and retain capital. The higher risk premium may partially—or totally—offset the gains in efficiency improvements. Moreover, competitive companies have the prerogative to increase management salaries, pay higher dividends to their investors, make investments in business operations, and/or reduce customer prices.

Combine these three factors, and one can appreciate why it is no easy task to provide a simple answer to the simple question, "does competition lead to lower prices?" The answer turns out to be anything but simple or inevitable. In most cases, the only correct answer is "it depends."

Perhaps because of these complicating factors, politicians in a number of U.S. jurisdictions that have passed restructuring legislation have insisted on *mandated price reductions*. A legislatively mandated 10-15 percent price reduction targeted at small residential customers (i.e., the voters), combined with a price freeze for everyone else, appears to be a popular political formula. It guarantees the support of a majority of the voters, while permitting larger customers to cut special deals with competing suppliers—something they will demand anyway. Some customers are made relatively better off, while nobody is made worse off, a so-called *Pareto superior* solution. Who can argue against such a deal?

Now a report titled, *The Impact of Competition on the Price of Electricity*, conducted by J. A. Wright and Associates of Marietta, GA, supports the notion that legislatively mandated price reductions may be the *only* pragmatic way to guarantee immediate lower prices. The report, which is focused on the 3 competitive markets in California, Massachusetts, and Rhode Island, concludes that the lower prices experienced so far have been the result of legislative mandates, not competitive market forces. The report, however, is not critical of competition. It points out that most of the benefits of competition are yet to come—once the transition period is over and utility's *stranded costs* have been written off.

Moreover, the report points out that, even setting the recovery of stranded costs aside, the costs of transitioning to a competitive electricity market are significant—and tend to be overlooked or underestimated. Finally, there are other subtle costs associated with a restructured market, including more volatile prices.

* Fereidoon "Perry" Sioshansi is a Partner with Convector Consulting Inc. in Menlo Park, CA. He edits and publishes the *EEnergy Informer*, a monthly newsletter. This is an edited version of an article which appeared in the October 1998 issue and is available on the web at http://members.aol.com/eeinformer

Conference Proceedings
18th North American Conference
San Francisco, California, September 7-10, 1997

The Proceedings from the 18th Annual North American Conference of the USAEE/IAEE held in San Francisco, CA, are now available from IAEE Headquarters. Entitled *International Energy Markets, Competition and Policy*, the proceedings are available to members for $75.00 and to nonmembers for $95.00 (includes postage). Payment must be made in U.S. dollars with checks drawn on U.S. banks. To order copies, please complete the form below and mail together with your check to:

Order Department, USAEE/IAEE Headquarters, 28790 Chagrin Blvd., Suite 350 Cleveland, OH 44122, USA.

Name _____

Address _____

City, State, Mail Code _____

Country _____

Please send me ____ copies @ $75.00 each (member rate) $95.00 each (nonmember rate).

Total enclosed $_____ Check must be in U.S. dollars and drawn on a U.S. bank, payable to IAEE.

International Energy Foundation

The Bahrain conference of the International Energy Foundation approved a series of resolutions pertinent to the coming ENERGEX conferences scheduled for Las Vegas in 2000, Krakow, Poland in 2002, Buenos Aires, Argentina in 2004 and Stavanger, Norway in 2006 summarized as follows:

- ENERGEX'98 achieved the objective of harmonization among energy researchers in all areas of energy. Through a united spirit of cooperation, coordination and communication the results of research in the technical, economic and human dimensions allowed researchers the opportunity and challenge of strengthening and enhancing our capacities and capabilities in responding to the needs of society.
- A prerequisite to the utilization of any form of energy is energy efficiency. This should be emphasized by all in research and in energy policy. This has the added benefit if minimizing environmental degradation and extending energy reserves.
- The action of government is required in order to remove the barriers which prevents the market penetration of renewable forms of energy in the transfer from an oil based economy to a future energy economy. Each nation is encouraged to use their energy resources with due consideration being given to the environment.
- There is a need for development of an environmentally sustainable energy policy which is both flexible and transparent. The development of such should be in concert with government, industry and academia.
- The precise energy resources and technologies which will be viable or even dominate energy use at any given point, cannot be predicted with certainty. The social and economic benefits of developing cleaner, cheaper energy resources are clear.

Those resolutions related to the Foundation are:

- The committee concurs with the Beijing and Seoul Resolutions and encourages the Foundation to proceed in finalizing these resolutions.
- Future ENERGEX conferences should incorporate not only the technical but also the continuation of inclusion of economic, social and environmental dimensions of energy. Specific sections on global climatic change and sustainable development are strongly recommended.
- The Foundation bestows the honour of Fellow to Dr. Eng, Mohammed J. K. Alghatam, President, University of Bahrain, and H. E. Sheikh Essa Bin Ali Al-Khalifa, Minister of Oil and Industry in recognition of their contribution to the global assistance in the fostering of energy technologies among developed and developing nations.
- The Foundation bestows the prestige title of Fellow upon Prof, Obasi, Secretary General, World Meteorological Organization; Dr. M. M. Al-Lababidi, Director of Technical Affairs Department, Organization of Arab Petroleum Exporting Countries; Dr, Anwar Al-Abdullah, Director of Oil and Gas Department, Cooperation Council for the Arab States of the Gulf, Secretariat General; Dr. Michael Lynch, Executive Director, Centre for International Studies, MIT, U.S.A.; Dr. N. Veziroglu, Director, Clean Energy Research Institute, U.S.A., and Dr Ali Sayigh, Director General, WREN, UK.
- The leadership and vision of H. H. Sheikh Isa Bin Salman Al-Khalifa in providing a mechanism for recognition of outstanding scientific contribution at global energy forums with the first presented at ENERGEX'93 in Seoul, Korea, the Foundation recommends that the Sheikh Isa Bin Salman Al-Khalifa Prize be formally integrated in future ENERGEX conferences as a legacy to his global commitment and dedication and that of the State of Bahrain, to energy education and research.

IAEE Awards Announced

The Association has announced the winners of its *Outstanding Contributions to the Profession, Outstanding Contributions to the IAEE* and *Journalism* awards for 1998.

Professor Colin Robinson of the Institute of Economic Affairs in London was selected to receive the *Outstanding Contributions to the Profession* award for his extensive contributions in more than 23 books and monographs and over 100 papers, which address important public policy issues relating to energy.

Dr. Subroto has been selected to receive the *Outstanding Contributions to the IAEE* award. While serving as Secretary General of OPEC, Dr. Subroto participated in the first public dialogue with the International Energy Agency at the IAEE International General Meeting in Honolulu, Hawaii in 1990. He appeared on numerous occasions at other IAEE meetings and provided much support for the organization including serving on the IAEE Council and as a Presidential Advisor.

Toni Mack, Senior Energy Editor for Forbes magazine, and John Jennrich, Editor and Publisher of Natural Gas Week were jointly selected to receive the *Journalism* award. Toni Mack was selected for her outstanding contributions on the strategy of major energy companies in oil, natural gas, electric power, and related areas of energy. Her work has focused on both large and small companies including Exxon, Royal Dutch Shell, PDVSA, Caltex, Enron, Niagara Mohawk Power, service companies, and small independent companies, globally.

John Jennrich was selected for his work and commentaries on the sweeping changes in the natural gas industry including barriers to open market competition, to the benefits of technology advancement and the resilience of the natural gas industry.

"All of the nominees have made a major impact on how industry, government, media, and the public think about energy and energy economics. They are an outstanding group of leaders in energy and energy economics. The Committee thanks the nominees for the privilege of selecting them for the awards and to the IAEE members who were thoughtful enough to nominate them," said Dr. Dennis J. O'Brien, awards committee chairman and past president of the IAEE.

All IAEE members were solicited and invited to submit nominations to the Awards Committee. The 1998 Awards Committee included Lori Cameron, Keichi Matsui and Hoesung Lee, in addition to O'Brien.

International Energy Foundation

ENERGEX 2000

8th International Energy Forum

Las Vegas, Nevada, July 23-28, 200

Call for Papers

You are invited to submit a one page abstract, prior to 15 February, 2000, for a paper to be presented at this conference.

Topics include:

Photovoltaics
Solar Thermal
Wind
Fuel Cells
Clean Coal Technologies
Sustainability
Deregulation
Energy Modeling
Architecture
Cogeneration
Transportation and Transmission
District Heating
Computational Fluid Dynamics
Applications
Hydrogen
Solar
Oil Recovery
Oil
Biomass
Economics
Energy Efficiency
International Reports
Nuclear Energy
Recycling & Waste Management
Global Warming.
Environmental Controls
Environmental Management
Renewable Energy
Geothermal
Fuels and Petrochemicals
Gas
Risk Assessment
Architecture and Energy Conservation
Ethical Issues
Education
International Lay and Energy
Energy Policy
International Standards

The conference will include technical sessions, plenary presentations, workshops, energy tours, energy exhibitions, international youth forum and international energy reports.

Sponsors include: National Renewable Energy Laboratory, US Department of Energy, Los Alamos National Laboratory, Argonne National Laboratory, Sandia National Laboratory, Federal Energy Technology Centre, Purdue University Calument, AQME (Canada) ABB Power Plant Technologies, American Council for an Energy Efficient Economy, Department of Primary Industries and Energy (Australia), ASE Americas Inc., James and James Publishers, Taylor and Francis Publishers, Purdue University, Texas A&M university, Solar Electric Light Fund, Geothermal Resources Council, National Hydrogen Association, University of Wisconsin, Milwaukee, Institute for Sustainable Power Inc., German Aerospace Research Establishment (Germany) and more.

Honourary Co-Chairpersons include, Admiral Richard Truly, Charles Gay, Rita Bajura, Carl Bozzuto, Kun Mo Chung, Dennis O'Brien, Tim Makay, Lise Brousseau and Howard Geller.

Send abstracts to one of the following:

Dr. Chenn Q. Zhou
Purdue University Calument
Department of Engineering
Hammond, IN 46323, USA
Ph: 219-989-2665
Fax: 219-989-2898
qzhou@calument.purdue.edu

Dr. Brian M. Golchert
Energy Systems Division
Argonne National Laboratory
9700 South Cass Avenue
Argonne, IL 60439-4815, USA
Ph: 630-252-6518
Fax 630-252-5210
brian_golchert@qmgate.anl.gov

Dr. Peter Catania
Faculty of Engineering
University of Regina
Regina, Saskatchewan., Canada S4S 0A2
Ph: 306-585-4364
Fax 306-585-4855
peter.catania@uregina.ca

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

International Energy Foundation (IEF) as a continuing contributor. In turn, the*Newsletter* is pleased to publicize the IEF ENERGEX series of conferences. It is hoped that this closer association of the IAEE and IEF will prove mutually satisfactory to both organizations.

Fereidun Fesharaki and David Isaak analyze Iranian oil figures in light of the dispute between Iran and OPEC over what baseline production figure should be used. They conclude that in 1998 Iran experienced a significant shift from a net product importer to a net exporter while at the same time seeing a marked increase in refining capacity. OPEC's figures do not reflect these changes and, therefore, Iran's figures are more reflective of the actual situation.

Ferdinand Banks discusses the economic aspects of nuclear retreat by Sweden and Germany. He notes that there is no comparable source of electricity that can match Sweden's on a cost basis, and this will, of course, be lost by retreat. Meanwhile the French are delighted with the German retreat as a liberalized Europe will give their nuclear power an opportunity to compete with German gas and coal facilities. The Finns (and Sweden, if they weren't pursing retreat) will also be able to enter the German market.

Barbara Wolcott reports that solar cell technology, being perfected in space applications, has a growing place in the commercial market in providing power for homes and backup power for commercial businesses. She describes the experience of the Sacramento Municipal Utility District and the development of a sleek solar roofing tile, closely resembling asphalt tiles, which is providing solar power to a select group of the company's customers. Further, she notes that a new type of lens for concentrating the sun's rays is in the offing that will provide still more power to these new solar roofing tiles.

William Edwards discusses the misconceptions of how oil prices are determined and the role played by crude oil producers, OPEC and Nymex in determining oil prices. He argues that it is the Nymex futures price that has actually been adopted as "the oil price" and OPEC has allowed this to happen. Since OPEC is responsible for this, he posits it is up to OPEC to adopt a revised approach.

Fereidoon Sioshansi comments on the move of UK power companies into the U.S. market and the problems any foreign investor faces in entering the United States. Despite these he expects more to try.

Sioshansi then looks at whether competition inevitably leads to lower electricity prices and concludes that there is no easy answer. In fact, the answer may be: "it depends". Finally he reports on a recent study that supports the notion that legislatively mandated price reductions may be the only pragmatic way to guarantee immediate lower prices.

IA
EE

Publications

Designing Competitive Electricity Markets. Edited by Hungpo Chao and Hillard G. Huntington. Price $89.95. Contact: Kluwer Academic Publishers, Order Department, PO Box 358, Accord Station, Hingham, MA 02018-0358. Phone: 781-871-6600. Fax: 781-871-6528. E-mail: kluwer@wkap.com

Gas Liberalisation in Europe. Price: £ 399. Contact: Management Reports, ICBI, 8th Floor, 29 Bressenden Place, London SW1E 5DR, United Kingdom. Phone: 44-171-850-5103. Fax: 44-171-850-5101.

The Future of the European Electricity Market. Price: £ 399. Contact: Management Reports, ICBI, 8th Floor, 29 Bressenden Place, London SW1E 5DR, United Kingdom. Phone: 44-171-850-5103. Fax: 44-171-850-5101.

Petroleum Economics: Issues and Strategies of Oil and Natural Gas Production, By Rognvaldur Hannesson. 176 pages. Price: $59.95. Contact: Greenwood Publishing Group, 88 Post Road West, PO Box 5007, Westport, CT 06881-5007. Phone: 203-226-3571. Fax: 203-222-1502.

Energy and Organization: Growth and Distribution Rexamined, By Bernard C. Beaudreau. 208 pages. Price: $65.00. Contact: Greenwood Publishing Group, 88 Post Road West, PO Box 5007, Westport, CT 06881-5007. Phone: 203-226-3571. Fax: 203-222-1502.

Future IAEE Events

June 9-12, 1999	22nd IAEE International Conference Rome, Italy *Hotel Parco dei Principi*
August 29-September 1, 1999	20th Annual USAEE/IAEE North American Conference Orlando, Florida, USA *Hilton at Walt Disney World Village*
September 20-21, 1999	BIEE Energy Conference St. John's College, Oxford, England
September 30-October 1, 1999	1999 European Conference Paris, France
June 7-10, 2000	23rd IAEE International Conference *Sydney Hilton* Sydney Australia
2001	24th IAEE International Conference Houston, Texas, USA

Calendar

25-26 February 1999, Australasia Energy Players. Sydney, Australia. Contact: Global Pacific & Partners, Suite 214, 68 Alexander Street, Crows Nest, Sydney NSW, Australia, 2065. Phone: 61-2-9460-6771. Fax: 61-2-9460-6778. E-mail: glopac@ozemail.com.au

1-3 March 1999, Asia Upstream '99. Singapore. Contact: Global Pacific & Partners, Suite 214, 68 Alexander Street, Crows Nest, Sydney NSW, Australia, 2065. Phone: 61-2-9460-6771. Fax: 61-2-9460-6778. E-mail: glopac@ozemail.com.au

3-4 March 1999, Electrifying Africa '99. Lost City Convention Center, Sun City Resort, South Africa. Contact: PennWell, 1421 South Sheridan Road, Tulsa, OK 74112. Phone: 918-831-9160. Fax: 918-831-9161.

3-5 March 1999, Power & Gas Industry Forum '99. Carlsbad, CA. Contact: Infocast, 13715 Burbank Blvd., Sherman Oaks, CA 91401. Phone: 818-902-5400. Fax: 918-902-5401.

4-5 March 1999, World Sustainable Energy Day 1999. Wels, Austria. Contact: Phone: 43-732-6584-4380. Fax: 43-732-6584-4383. E-mail: esv1@esv.or.at

25-26 March 1999, Brazil Energy '99. Miami, FL. Contact: Registration Dept., Center for Business Intelligence, LLC, 500 W Cummings Park, Suite 5100, Woburn, MA 01801. Phone: 781-939-2438. Fax: 781-939-2490. E-mail: registrar@cbinet.com

11-13 April 1999, Middle East Petroleum & Gas Conference. Gulf Hotel & Int'l Convention Center, Bahrain. Contact: Conference Connection, 212A, Telok Ayer Street, Singapore 068645. Phone: 65-226-5280. Fax: 65-226-4117.

20-22 April, 1999, Electric Power '99 - Conference & Exhibition, Baltimore, Maryland, USA. Contact: Electric Power '99, c/o The TradeFair Group, Inc. 1220 Blalock, Suite 310, Houston, TX 77055. Phone: 713-463-9595. Fax: 713-463-9997. E-mail: event@electricpowerexpo.com

27-30 April 1999 Commercial Contracts in the International Oil and Gas Industry. University of Dundee, Dundee, Scotland. Contact: Moira McKinlay, Centre for Energy, Petro. And Min. Law & Policy, University of Dundee, Dundee DD1 4HN, Scotland, UK. Phone: 44-1382-344303. Fax: 44-1382-345854.

3-6 May 1999, International Oil and Gas Investment: The Legal, Regulatory and Tax Framework. University of Dundee, Dundee, Scotland. Contact: Moira McKinlay, Centre for Energy, Petro. And Min. Law & Policy, University of Dundee, Dundee DD1 4HN, Scotland, UK. Phone: 44-1382-344303. Fax: 44-1382-345854.

4-6 May 1999, IEA International Workshop on Technologies to Reduce Greenhouse Gas Emissions: Engineering-Economic Analyses of Conserved Energy and Carbon. Washington, DC, USA. Contact: John Newman, IEA, Phone: 33-1-40-57-67-15. Fax: 33-1-40-57-67-49. E-mail: john-newman@iea.org or

(continued on page 32)

Conference Proceedings
19th USAEE/IAEE North American Conference
Albuquerque, New Mexico, October 18-21, 1998

The Proceedings from the 19th Annual North American Conference of the USAEE/IAEE held in Albuquerque, New Mexico, are now available from IAEE Headquarters. Entitled *Technology's Critical Role in Energy & Environmental Markets*, the proceedings are available to members for $85.00 and to nonmembers for $105.00 (includes postage). Payment must be made in U.S. dollars with checks drawn on U.S. banks. To order copies, please complete the form below and mail together with your check to: Order Department, IAEE Headquarters, 28790 Chagrin Blvd., Suite 350 Cleveland, OH 44122, USA.

Name _____

Address _____

City, State, Mail Code and Country _____

Please send me ____ copies @ $89.95 each (member rate) $99.95 each (nonmember rate).

Total enclosed $_____ Check must be in U.S. dollars and drawn on a U.S. bank, payable to IAEE.

Calendar *(continued from page 31)*

Jeffery Dowd, US DOE, Phone: 202-586-7258. Fax: 202-586-4447. E-mail: jeff.dowd@hq.doe.gov

10-14 May, 1999, Basic Petroleum Economics. University of Dundee, Dundee, Scotland. Contact: Moira McKinlay, Centre for Energy, Petro. And Min. Law & Policy, University of Dundee, Dundee DD1 4HN, Scotland, UK. Phone: 44-1382-344303. Fax: 44-1382-345854.

17-21 May, 1999, World Fiscal Analysis for Petroleum. University of Dundee, Dundee, Scotland. Contact: Moira McKinlay, Centre for Energy, Petro. And Min. Law & Policy, University of Dundee, Dundee DD1 4HN, Scotland, UK. Phone: 44-1382-344303. Fax: 44-1382-345854.

18-20 May 1999, Electricity in Europe'99. Berlin, Germany. Contact: Conference Secretary, Electricity in Europe '99, ICBI, 8th Floor, 29 Bressenden Place, London SW1E 5DR. Phone: 44-171-915-5103.

9-12 June 1999, 22nd IAEE International Conference. Rome, Italy. Contact: IAEE Headquarters, 28790 Chagrin Blvd., Ste. 350, Cleveland, OH 44122. Phone: 216-464-5365. Fax: 216-464-2737. E-Mail: iaee@iaee.org URL: www.iaee.org

August 29 - September 1, 1999, 20th USAEE/IAEE Annual North American Conference - "The Structure of the Energy Industry: The Only Constant is Change." Orlando, Florida, USA. Contact: USAEE/IAEE Headquarters, 28790 Chagrin Blvd., Ste. 350, Cleveland, OH 44122. Phone: 216-464-5365. Fax: 216-464-2737. E-Mail: iaee@iaee.org URL: www.iaee.org

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

20-21 September 1999, A New Era for Energy? Price Signals, Industry Structures and Environment. 1999 BIEE Conference, St. John's College, Oxford, England. Contact: Mary Scanlan**,** 37 Woodville Gardens, London, W5 2LL, United Kingdom. Phone: 0181 997 3707; Fax 0181 566 7674.

22-24 September 1999, 2nd International Energy Symposium. Stift Ossiach, 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

30 September - 1 October, 1999, Technical Progress and the Energy Challenges. 1999 IAEE European Conference. Paris, France. Contact Denis Babusiaux, 228-232 avenue Napoleon Bonaparte, 92500 Rueil Malmaison, France. Fax 33-1-47-52-70-66; e-mail denis.babusiaux@ifp.fr

18-20 October 1999, Hydropower into the Next Century. Gmunden, Austria. Contact: Aqua-Media International Ltd., Westmead House, 123 Westmead Road, Sutton, Surrey, SM1 4JH, United Kingdom. Phone: 44-181-643-4727. Fax: 44-181-643-8200. E-mail: conf@hydropower.cix.co.uk

7-10 June 2000, 23rd IAEE International Conference. Sydney, Australia. Contact: IAEE Headquarters, 28790 Chagrin Blvd., Ste. 350, Cleveland, OH 44122. Phone: 216-464-5365. Fax: 216-464-2737. E-Mail: iaee@iaee.org URL: www.iaee.org

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

IA
EE

IAEE Newsletter

Volume 8, First Quarter 1999

The *IAEE Newsletter* is published quarterly in February, May, August and November, by the Energy Economics Education Foundation for the IAEE membership. Items for publication and editorial inquiries should be addressed to the Editor at 28790 Chagrin Boulevard, Suite 350, Cleveland, OH 44122 USA. *Phone:* 216-464-5365; *Fax*: 216-464-2737. Deadline for copy is the 1st of the month preceding publication. The Association assumes no responsibility for the content of articles contained herein. Articles represent the views of authors and not necessarily those of the Association.

Contributing Editors: *Paul McArdle* (North America), Economist, US Department of Energy, Office of Policy, Planning and Analysis, PE-50, Washington, DC 20585, USA. *Tel*: 202-586-4445; *Fax* 202-586-4447. *Tony Scanlan* (Eastern Europe), 37 Woodville Gardens, London W5 2LL, UK. *Tel* 44-81 997 3707; *Fax* 44-81 566 7674. *Marshall Thomas* (Industry) 3 Ortley Avenue, Lavallette, NJ 08735, USA *Tel* 908-793-1122; *Fax:* 908-793-3103.

Advertisements: The IAEE Newsletter, which is received quarterly by over 3300 energy practitioners, accepts advertisements. For information regarding rates, design and deadlines, contact the IAEE Headquarters at the address below.

Membership and subscriptions matters: Contact the International Association for Energy Economics, 28790 Chagrin Boulevard, Suite 350, Cleveland, OH 44122, USA. *Telephone:* 216-464-5365; *Fax:* 216-464-2737; *e-mail:* IAEE@IAEE.org; *Homepage:* http://www.IAEE@IAEE.org

IAEE Newsletter
Energy Economics Education Foundation, Inc.
28790 Chagrin Boulevard, Suite 350
Cleveland, OH 44122 USA

NONPROFIT ORG.
U.S. POSTAGE
PAID
Cleveland, OH
Permit No. 1860