IAEE INTERNATIONAL ASSOCIATION FOR ENERGY ECONOMICS

IAEE Newsletter

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

Summer 1996

President's Message

I am sure that everyone who attended the Budapest conference came away with the same feeling of success that I did. I wish to thank, on behalf of the Council and the membership, Tamas Jaszay and his committees on a job well done.

The conference, reported on a separately in this issue, afforded an excellent opportunity for energy economists from around the world to interact with Eastern European energy planners who are fostering an energy transition in that part of the world.

I would like to call your attention to one important item from the IAEE Council meeting. The Investment Committee, cognizant of the reserve fund status of the Association, recommended the establishment of a new IAEE Foundation to promote energy economics in developing countries, and to encourage the education and development of energy economists.

This recommendation is consistent with my initiative to broaden and deepen our membership. I appointed a three person committee to follow up on this development. I expect them to complete their report by June 1997 and would welcome any suggestions on this matter from the membership at large.

I would like to congratulate the Danish Association on their 10th Anniversary which will be celebrated by a regional conference on *Transport, Energy and Environment*. This October meeting highlights the importance of the transport sector to long-term energy demand and environmental goals.

The USAEE is in the final stages of planning for the North American conference of the IAEE to be held in Boston this October. The meeting, emphasizing aspects of energy deregulation, should be useful for all members interested in the changes sweeping all energy sectors. I encourage your attendance.

See you in Boston.

Tony Finizza

*****ATTENTION - URGENT - ATTENTION*****

20th IAEE International Meeting

The 1997 International Meeting is early in 1997 - January 22 to 24 to be specific. It is set early in the year to get the best of the New Delhi, India weather. Be sure to note the details on page 3 and act promptly. Note that the deadline for paper submission has been extended to September 15. Do not delay in making your plans and submitting your paper. Further details will be mailed shortly.

Editor's Note

The 1996 International Meeting in Budapest was truly and outstanding affair. Tamas Jaszay, Laszlo Lengyel and their committees did a fine job on the program and all the many arrangements. Our congratulations to them.

We're pleased to be able to include in this issue a number of the papers given at plenary sessions at the meeting. Most of the papers given at the concurrent sessions are included in the Proceedings of the meeting which can be ordered from Headquarters using the order form on page 26 of this *Newsletter*. Additional papers from other of the plenary sessions will be carried in the Fall issue of the *Newsletter*.

We begin with an article by Morris Adelman in which he traces the history of the global economy, commenting that "globalization" is not new, but indeed over 400 year old. He goes on to discuss the spurs and deterrents to globalization, emphasizing the importance of competition in its development.

Next, John Ferriter discusses the world energy outlook from the perspective of the IEA, noting both its *Capacity Constraints* and *Energy Savings* scenarios. He then examines the implications of these for the central and eastern European economies.

Rilwanu Lukman, OPEC's Secretary General, discusses the major influences on world energy over the remaining years of this century noting how these contribute to energy interdependence and how it affects OPEC's view of the world energy market. He concludes with a plea for more cooperation between

(continued on page 3)

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

(De)Regulation of Energy: Intersecting Business, Economics and Policy

17th USAEE/IAEE Annual North American Conference - October 27-30, 1996
Boston, Massachusetts, USA - Boston Park Plaza Hotel

Sponsored by:
USAEE/IAEE

If you're concerned about the future of the energy industry and profession, then this is one meeting you surely don't want to miss. The 17th USAEE/IAEE Annual North American Conference will detail the current developments within the energy field so that you come away with a better sense of energy supply, demand and price. Seven plenary sessions will address the following issues:

Energy Reform Overseas: Experience & Potential
Continental Energy Integration
Utility Restructuring
Oil Markets in a Deregulated World
Finance, Theory and Practice
Energy and Security
Environmental Regulation: Regulatory Reform in a Political Economy

Our opening keynote speaker is Alfred E. Kahn, Special Consultant of National Economic Research Associates. He will address the issue "The Deregulation Revolution." Further, speakers, Daniel Yergin, President of the Cambridge Energy Research Assoc. and Paul L. Joskow, Mitsui Professor of Economics, MIT, will provide thought provoking energy perspectives from around the world.

In addition, 24 concurrent sessions are planned to address timely topics that effect all of us specializing in the field of energy economics.

We will also host an energy debate. Our intention is to have the energy advisers of the Presidential candidates debate energy issues and policies that effect our industry. Given the coming U.S. election this session should prove most enlightening. To date, the confirmed and/or invited speakers include the following:

Martin Allday, Scott, Douglass, Luton & McConnico
John-Pierce Ferriter, International Energy Agency
William W. Hogan, Harvard University
Jim Jensen, President, Jensen Associates
Paul Leiby, Oak Ridge National Laboratory
Richard D. Morgenstern, Resources for the Future
Hector Olea, Comision Regulador de Energia, Mexico (invited)
Silvia Pariente-David, DRI/McGraw-Hill, Inc.
Andre Plourde, University of Ottawa
Roland Priddle, National Energy Board, Canada
Mark Rodekohr, U.S. Department of Energy
Richard L. Schmalensee, MIT
David C. Shimko, JP Morgan (invited)
Robert N. Stavins, Harvard University
Michael Toman, Resources for the Future
John E. Treat, Booz-Allen & Hamilton
Adrian Lajous Vargas, Petroleos Mexicanos (invited)
Trevor Chrismtmas, International Petroleum Exchange
Mine Yucel, Federal Reserve Bank of Dallas

More prominent speakers who are on the cutting-edge of energy economic issues are being added to address this annual meeting.

Boston, Massachusetts is a wonderful place to meet and at affordable prices. Single nights at the Boston Park Plaza Hotel are $122.00 (contact the Boston Park Plaza Hotel at 617-426-2000, ext. 2500, to make your reservations). Conference registration fees are $425.00 for USAEE/IAEE members and $525.00 for non-members. Special airfares have been arranged through Traveline (for absolutely the lowest zone fares, call Traveline at - 216-646-8525). These prices make it affordable for you to attend this 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 can become involved with this valuable conference. You may wish to attend for your own professional benefit or your company may wish to become a sponsor or exhibitor at the meeting whereby it would receive broad recognition. For further information on these opportunities, please fill out the form below and return to USAEE/IAEE Headquarters.

(De)Regulation of Energy: Intersecting Business, Economics and Policy

17th Annual North American Conference of the USAEE/IAEE

Please send me further information on the subject checked below regarding the October 27-30 USAEE/IAEE Conference.

____ Registration Information ____ Sponsorship Information ____ Exhibit Information

Name: _____

Title _____

Company _____

Address _____

City, State, Zip _____

Country _____ Phone/Fax _____

USAEE/IAEE Conference Headquarters
28790 Chagrin Blvd., Suite 210
Cleveland, OH 44122 USA
Phone: 216-464-2785 Fax: 216-464-2768

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

OPEC and non-OPEC producers and consumers.

IAEE's 1995 Journalism Award winner was Neil Fleming of Platt's *Global Alert*. In his response to the award presentation he looks at where the world of oil journalism stands and how it fits into the industry. He expresses concern about the tendency to think of news as an absolute – to equate events with reports on events. He goes on to introduce the concept of *news creep* in the oil markets which he defines as the tendency of oil markets to react earlier and earlier to things which have not yet happened, and suggests that its origin lies in a structural shift in the oil news media. He concludes with the thought that *news creep* has contributed to market instability and opened up a reality gap between what OPEC does, the real effects of what it does and what the market expects it to do.

Of especial interest to the energy economist is Paul Tempest's article on the role of the energy economist in world petroleum today. Tempest begins by explaining the background, structure, purposes and focus of interest of the World Petroleum Permanent Council and the World Petroleum Congress. He goes on to comment on ten key areas of current interest to petroleum company executives concluding that there is considerable optimism in the industry today. He tempers this optimism by noting three major reservations he harbors. Finally he looks at where the energy economist fits into the current petroleum company picture. His conclusion on the prospects for the energy economist are particularly noteworthy.

Robert Ebel looks at the nuclear energy situation in the Former Soviet Union, relating several anecdotes to highlight nuclear-related hazards and concludes that the FSU is full of opportunities for nuclear disasters; all the while, the West seems to concentrate solely on Chernobyl. He provides thumbnail sketches of the situations in Russia, Ukraine, Armenia and Lithuania and concludes there will be no dramatic change for nuclear power in the FSU, though there will be new reactor construction and the search for new reactor business by the Russians will bring further confrontation with the U.S.

We have two articles on China. In the first, Mamdouh Salameh looks at the future of the Chinese oil industry noting China's declining oil reserves and rapidly growing domestic consumption. He notes that China is under increasing pressure to find new reserves and is targeting the Tarim basin as well as the Spratly Islands in the South China Sea. He discusses the potential for armed conflict involving the latter area as there are five other claimants to the Islands which lie atop substantial oil and gas reserves.

Xiaojie Xu discusses the deregulation of China's oil and gas sector in order to spur competition and enhance production. He is hopeful that a new petroleum law, a shift of policy priorities, a more open foreign policy and an independent regulatory authority will enable this.

Finally, Ernest Zampelli uses a panel data set of 18 large petroleum companies to examine the determinants of R&D expenditures for oil and gas recovery. The econometric results are consistent with the view that only firms with very large reserves have adequate incentives to engage in R&D. The analysis also indicates that incentives to engage in R&D are far from uniform.

DLW

The
INTERNATIONAL ASSOCIATION FOR ENERGY ECONOMICS
Announces

The 20th International Conference

Energy and Economic Growth: Is Sustainable Growth Possible?

To Be Held At The

India Habitat Center
New Delhi, India
January 22-24, 1997

Conference Themes:

- Global energy economy and the developing countries.
- Minimum energy needs, social development and economic growth.
- Environmental concerns and the limits to energy and economic development.
- Role of technology in global sustainability.
- Issues in capital flows for energy development in Asia.

***** CALL FOR PAPERS *****

Deadline for Submission of Abstracts: September 15, 1996

Anyone interested in organizing a session should propose topics, objectives and possible speakers. Abstracts should be between 200-500 words giving an overview of the topic to be covered at the conference. 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:

Dr. Leena Srivastava
Dean, Policy Analysis Division
Tata Energy Research Institute
Darbari Seth Block (III floor), Habitat Place
Lodi Road, New Delhi - 110 003
INDIA

Phone: 91-11-4622246 or 4601550
Fax: 91-11-4621770 or 4632609

The 20th IAEE International Conference is being hosted by the Indian Association for Energy and Environmental Economics (IAEEE) and the Tata Energy Research Institute (TERI).

General Conference Chairman:
Dr. R.K. Pachauri

Technical Committee Chairperson:
Dr. Leena Srivastava

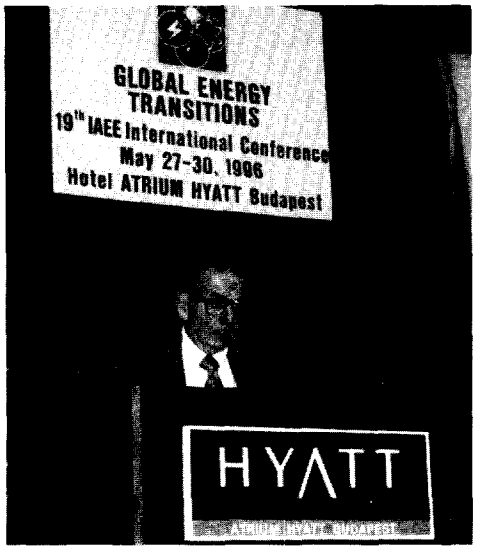
Globalization of the World Economy

*By Morris A. Adelman**

"Globalization of the world economy" rolls trippingly off the tongue. The thing itself is 450 years old. By 1600 A.D. there was large scale trade from the Americas and Asia into Europe. A poor country - Spain - used its great new mineral wealth from the Americas to support all its old unproductive habits and to buy glory. The sun never set on the Spanish domains, the first global empire in history. It did not shine there for long.

Global trade expanded greatly from 1600 to 1800, despite wars and the controls of which Adam Smith wrote with such graceful scorn. But after 1800, trade and now investment flows increased much faster. John Maynard Keynes summed up:

> "What an extraordinary episode in the economic progress of man that age was which came to an end in August 1914! ... The inhabitant of London could order by telephone...the various products of the whole earth ... and by the same means adventure his wealth in the natural resources and new enterprises of any quarter of the world ...or... any substantial municipality in any continent. He could secure ...cheap and comfortable means of transit to any country or climate ... (without) ... the least interference. But, most important of all, he regarded this state of affairs as normal, certain, and permanent, except in the direction of further improvement, and any deviation from it as aberrant, scandalous, and avoidable...(M)ilitarism and imperialism, racial and cultural rivalries, monopolies, restrictions, and exclusion ... were little more than the amusements of his daily newspaper." (Keynes 1920, pp. 11-12)



Morris Adelman addresses the conference.

Thus the freedom to move people, goods and capital allowed massive investment for expansion and improvement. But then as now, one set of political forces lets the process work, and another set can stifle or break it. Global expansion is no gift of nature, there is nothing certain about it.

In fact, recovery after World War I was slow and incomplete. Trade and investment were stifled. The global economy became ever more fractured. To my generation, which came of age in the great depression and World War II, further breakdown looked all too likely.

But the quarter-century after 1945 saw a great expansion, and restoration of world trade. Progress was much less in the Communist blocks into which Central Europe was long submerged. Today they are back in the global economy after a miserable detour in Russia "seventy-five years on the road to nowhere."

But expansion slowed greatly after 1973. Every large developed economy suffered a sharp down-deflection in the growth of output and productivity. The fastest-growing, Japan, slowed the most.

Some of the deflection must have been due to the oil price shock. What a disproportion between cause and effect! We are told that in the right conditions the beating of a butterfly's wings can set off a hurricane. Perhaps this was such a case. The oil production cutback in late 1973 was very small. It was less than the net inventory additions in the previous nine months. But fear of the unknown caused panic: a surge in precautionary and speculative demand for ever-more inventories, which multiplied the price several times over.

After price volatility up, and with overflowing oil stocks and excess productive capacity, one would expect volatility down. But the producing nations curtailed supply enough to drive the price much higher still. In 1978-79 came the same sequence: threats, panic, a price surge; then a further cooperative ratcheting-up of price.

Each oil price shock was amplified by the disrupted world payments system, the anticipated kick to inflation, the direct price controls and monetary contraction, and much more. Energy demand contracted in response to the higher price, but only by diverting investment away from where it would have gone to raise productivity.

More price shocks were expected because it was known - *known!* - that the wells were drying up, and the world was running out of oil. The ghost is still at large. We still read that "growing demand" and "tight markets" may bring another "oil crunch." But each price spike came when supply was ample or in excess. Only deliberate action made oil scarce.

Comparing now, 1996 with 1914: freight transport is much faster, personal travel is many times faster, communication sometimes infinitely faster. In fact, radio and television may have destroyed the Communist blocks. These economies did not collapse. There was no famine. The standard of living rose, very slowly. But the inhabitants came to know something of the outside. Chernobyl in 1986 might have been kept a leaky secret, but not when the news of fallout came quickly across the border from Sweden and Germany.

The second change from 1914 is one aspect of communications. Financial assets can now move so fast that the difference of degree has become one in kind. I will refer again to this. The third change has been the climb of some of Asia toward or into the ranks of the developed countries.

The fourth big change from pre-1914 is the end of colonialism. It was inevitable, and welcome. But many newly independent nations tightly controlled and distorted their

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*Morris A. Adelman is Professor Emeritus at the Center for Energy & Environmental Policy Research, MIT. This is an edited version of his remarks at the 19th IAEE International Conference, May 27-30, 1996 in Budapest, Hungary.

economies. Some expropriated mineral and other assets, or set terms which claimed so much of the prospective rent as to abort investment. The high barriers to investment are now decreasing, very slowly. Half of the world's oil and gas is still produced by State companies. Outside investment is barred. Similarly with most of the world's electric power, and other industries.

Nations, new and old, have been slow to see the results of a poor reputation in financial markets. There is a 150-year-old lesson from my own country. In the 1840s, many States of the young American Republic borrowed heavily from European lenders, then defaulted. Eventually, they all paid up, having decided that reputation was too valuable to lose, or even to impair.

Perhaps the revised contract with Enron will benefit the Maharashtra state in India. But there is an offsetting cost – a contract voided after signing is a classic political risk. Indian borrowers and perhaps others will pay more in interest charges, or do without.

Russia has just rescheduled interest payments to foreign creditors. It would have gained many times as much in revenues as in loans had it been willing to make contracts with foreign oil companies. But inability to see risk and return, holding back promising areas but not developing them, demanding the impossible in order to split the difference, piling on taxes or local demands, etc., have kept the potential from becoming actual. The losses from not producing oil far exceed any possible gains from better terms.

Russian pipeline charges may well extract most of the rent on Central Asia production. But it will be a high proportion of a low rent. As the French say: you pay for your pleasures. The payment will be: all the rents aborted by preventing investment.

Prime Minister Chernomyrdin fears that "the West is undermining the security of the [Former Soviet Union] by seeking to exploit their oil and natural gas reserves." (*Wall Street Journal*, May 14, 1996, p. A17.) It would certainly undermine his declared aim: "a cartel to coordinate production, exports, tariffs and taxes," to enrich his friends at the expense of everyone else. But with no outside competition for investment, the total will be much less.

Globalization means the injection of competition: widening markets to inflict rivalry on business firms once shielded by barriers of distance, tariffs, regulation, language, etc. As more governments permit access to foreign investment, a particular government's excessive demands will drive the investors elsewhere. Conversely, as the circle of investors widens – as in international oil – it becomes hard or impossible to exploit even a small unsophisticated country, lest some other company jump in to make a better offer.

These examples show that to understand the global economy today, we need both politics and economics. But the more the two are mingled in practice, the greater the need to separate them in analysis. Neglect of the need sows confusion.

The supposed competition among nations, "the younger rises when the old doth fall," is poetry. Competition is among business firms. If the firms succeed and grow, the increasing income can benefit the nation. Conversely, the politics and society of any nation may make the business firms' success more likely, and economic progress: attitudes to work and to postponing consumption; health and education; the rule of law; contract enforcement; freedom of information and movement.

Relations among States are governed by power, which is purely relative, a zero-sum game. In competition among firms, within or across national boundaries, there are winners and losers, but the total is always a net gain.

Of course, we hear today, as ever, that the low-wage countries will conquer the earth. In my country, it is "unfair" competition from Mexicans or Asians; elsewhere they many demand protection from cheap foreign goods produced, I suppose, where capital is "unfairly" cheap.

Wages are only one cost, sometimes important, sometimes not. But never mind that. If some lucky nation could produce everything more cheaply, had an advantage over everybody, it would still benefit by doing only the things where its advantage over others was greatest, and importing everything else. And if one were least efficient in everything, it would do those things which it was in the others' interest to let go. The competitive result holds even under these wildly unrealistic assumptions.

Some years ago we heard anew about "strategic trade theory." Imagine an industry with economies of scale, or great gains on the learning curve. Subsidize or protect a firm to get the perpetual momentum of an early start, and the benefits of a great new industry. On paper, it is smooth sailing compared with private markets which at best are full of inertia and error, blind alleys, wasted effort.

The trouble with this strategy of picking winners is that they are probably losers. Worse yet: those in authority can not admit the mistake, but keep pouring, out of the public purse, good money after bad. Vested interests quickly build up, who persuade themselves and others that a running sore is a national asset.

This confusion affects international trade politics. Years ago, Japanese automobile makers began to export, especially to the United States. This was opposed by the Ministry of International Trade and Industry (MITI), the mythical general staff of mythical Japan, Inc. One reason the Japanese auto-makers succeeded was that the U.S. firms had become inefficient as producers and blind to consumers' wants, for a time.

But another coincidence was far greater and more stubborn. My country has in recent decades had a very low savings rate. Add a budget deficit, and we have aggregate national dis-saving. To maintain spending, we borrow from others. These dollar flows represent real goods and services. To consume and invest more than we produce, we import more than we export.

So the U.S. balance-of-payments deficit is due entirely to low saving and the budget deficit. It has nothing whatever to do with any nation's trade restrictions. In fact, a nation's bilateral deficit with any one country is no more significant than my permanent deficit with the barber shop where I always buy and never sell. (There is now some heavy breathing over the U.S. trade deficit with China. If we include Hong Kong, the deficit is only half as large, but just as meaningless.)

But for over a decade, my government has engaged in a senseless brawl with Japan, subverting our own free trade

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MEXICAN ASSOCIATION FOR ENERGY ECONOMICS

In collaboration with the

INTERNATIONAL ASSOCIATION FOR ENERGY ECONOMICS

and the

UNIVERSITY ENERGY PROGRAM OF UNAM, MEXICO

Presents

ENERGY TRANSITIONS IN MEXICO, CENTRAL AND SOUTH AMERICA

To be held in Mexico City, Mexico

September 23-25, 1996

Significant changes have occurred or are under way in the energy sectors throughout Latin America. Privatization, deregulation, regional integration are important trends in Central and South America; and Mexico, to a limited extent, is no exception. The concern for the environment is already influencing energy policies and the physical and financial structure of the energy suppliers, as well as their development plans. The Congress will provide an analysis of the current situation and of the expected evolution of the Latin American energy systems in both the external and internal contexts.

The main themes of the Congress – Latin America in the world energy market; regional energy markets; deregulation in the energy sector; externalities of energy chains – will be addressed in the following panels, assembled jointly by executives of the Mexican energy sector and the IAEE:

- Global overview of energy markets
- The upstream oil sector in Latin America: present and future
- The downstream oil sector in Latin America: regional and global markets
- Deregulation in the power sector: Latin American experiences and prospects
- Environmental externalities of energy systems
  - Part I: mitigation through technology and energy efficiency
  - Part II: impact on energy costs and prices

Concurrent paper sessions can cover other topics in addition to the above.

This Second National Congress is being sponsored by the Mexican public energy sector, with the participation of its top level executives and policy makers in the plenary discussion panels and invited lectures. As these will address matters of continental concern, a similar participation from the foreign public and private energy sectors and related industries is assured.

Registration Fee:	Members AMEE/IAEE	US$ 70.00
	Non members	US$ 85.00

The Congress will be held at the Technological Museum of the Comision Federal de Electricidad (Federal Electricity Commission), in Chapultepec Park. Information about convenient hotels will be provided.

Inquiries should be submitted to:

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Globalization of the World Economy *(continued from page 5)*

goals by demanding quotas for computer chips and for automobiles which nobody wanted to buy. Yet many believe that the balance-of-payments deficit has some relation to Japanese restrictions on U.S. exports. (To make a bad joke worse, we prohibited the export of Alaskan oil.)

The brawl is good theater: trade war, conflict of giants, Asian versus Western economics, etc. The fact is more dreary and ordinary: each side pays off some domestic supporters, penalizes its own consumers, avoids responsibility for difficult actions, and blames the foreigner.

The brawl has been pushed aside – permanently, one hopes – by concern for security, the need for American-Japanese unity to maintain peace in East Asia. That region is today as vulnerable as 1914 Europe to the "militarism and imperialism, racial and cultural rivalries" which so damaged the older global economy.

A final area of mixed economic-political forces: it is possible that the near-instant financial markets have helped restrain inflation in the past decade. It is another case of lower barriers to investment wiping out barriers to market action. Governments perceived as favoring inflation – or not sufficiently opposing it – may be penalized immediately by capital movements and higher interest rates. But the preceding 20 years saw an inflationary surge. I think the financiers' increased use of computer networks was only part of the process. More important in keeping prices stable was the gradual buildup of a worldwide revulsion against continued accelerating price increases.

In many countries, not long ago, there was a kind of social compact or understanding. Since everyone expected prices and wages to keep rising, it made good sense to contract now for higher wages, to keep from losing labor. With higher wages and other factor payments, it was a good bet that prices next year would indeed be higher. The inflationary circle was complete.

I think there is some nostalgia for that old "social compact", the system of channels for permanent inflation. Trade which is out of the loop of any agreement is always disruptive. But "the need to compete in the global economy" means the need to do what competition forces us to do, wherever the source of the competition.

To see changing economic forces at work in a political setting, let me conclude by looking at some of the energy industries in my own country. The lessons apply elsewhere.

The natural gas industry in the United States (and Canada) has been turned upside down. A decade ago, field prices were still under ceilings, and the rest of the industry was a set of hermetically sealed channels running from producers to pipelines to local distributors, with prices set under long-term contracts at each toll gate.

But while producers, pipelines and consumers fought over regulation, the battle appeared ever less relevant. They all had assumed growing scarcity of gas, and had signed "take or pay" contracts for future delivery at extravagant prices. Partial deregulation and more competition forced them to see a fact: increasing volumes of gas at constant or declining costs, hence lower prices.

Complete North American deregulation was less a political choice than an intelligent political reaction to surplus gas and technological advances which made marketing far easier. We are now close to a huge network in which thousands of producing centers, many pipelines and junctions, and hundreds of local distributors are in instant communication, any one with any other. Gas flow is governed by a price system, everything from spot deals to long-term contracts, which is far more sensitive and accurate in registering supply and demand, and doing the job of allocating much more economically.

It did not just happen, and government had to do more than simply get out of the way. Buyers and sellers needed instant access to pipeline systems, who were compelled to pay their way by transporting not owning gas.

In the electric power industry, a similar evolution is under way. Generation is in large plants, of course, but if they can be tied together in a transmission network, it becomes a national market so large that there is room for many competing producers. Transmission will be governed by a pool allowing firms to buy and sell as in a commodity exchange, matching bids and offers. It is harder to accomplish, of course, than a gas network, because unlike gas, electricity cannot be stored. And as with gas, there is a very large amount of "stranded assets", facilities which were built at huge expense to cope with shortages which never arrived. It is a sensitive issue: who is to bear that cost.

Coal, the principal fuel for electricity, has become much cheaper. Mine-mouth ("pithead") prices declined, although coal is like oil a "limited non-renewable resource". More important, deregulation of railroad rates allowed low costs to be translated into a drastic fall in coal freight charges. Low-sulfur coal from the Rocky Mountains became much cheaper in the big coal-burning States.

North America has shrunk. As markets have merged in gas, coal, and electricity, costs and prices are down. This is globalization, seen close up.

There is no better place than Budapest to point out that the technology and basic economics are no different in what General de Gaulle called "Europe from the Atlantic to the Urals." (One difference: in 1966 I wrote that coal in Europe was "no longer an industry, only a means of social insurance.")

As Michael Lynch and I pointed out in 1986, the underlying physical and economic fact is the enormous amount of cheap gas which could be made available to the European market if producers would compete. Small clubby groups find this hard to do. They are, very slowly, shedding the belief that holding back gas is a good investment. It has proved a very bad one. They will begin to compete – slowly, unwillingly, but irretrievably. The Interconnector gas line from the U.K. to the Continent may some day be seen as the thin end of the wedge of a transformation that would greatly benefit the European economy.

"Globalization of the world economy" consists of expanding markets and lower prices and costs. But its political environment in the next decades is not clear.

I mentioned earlier the 25-year period of slow growth in the industrial countries. It certainly is not due to any destructive imports from Asian newcomers, too small even now to have much impact. Much of the high unemployment

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The World Energy Outlook: Implications for Economies in Transition

*By John P. Ferriter**

The energy outlook for the European economies in transition is a timely topic. Many of these countries have reached a critical turning point in the transition process. In the past seven years, central and eastern European countries have passed through a difficult period of economic readjustment and hardship. Declining economic activity has led to a significant contraction of energy production and use in the region. For the last two years, however, many of these countries have begun to enjoy economic recovery. This means their need for energy is rising again. This will require a continued, sustained effort to adapt and restructure their energy sectors to lay the foundation for dynamic economic growth into the 21st century.

In examining the implications for central and eastern European economies of the IEA's recently released World Energy Outlook, I plan to emphasize four points:

- World energy patterns are changing, but energy demand is expected to grow steadily as it has over the last two decades. Fossil fuels will still account for nearly 90 percent of global energy consumption by the year 2010.
- Demand for fossil fuels will increase rapidly, with most of the growth coming from developing countries.
- Energy security is still a top priority. As their economies modernize, it will be increasingly important for economies in transition to protect themselves from potential supply disruptions.
- Since 1991, the IEA has worked closely with central and eastern European countries to help them establish competitive and open energy markets as a condition for successful economic reform and sustainable growth. Among these countries, the Czech Republic, Hungary, Poland, the Slovak Republic and Slovenia have applied to become IEA members; the Czech Republic and Hungary have recently become members of OECD, which is one of the preconditions for IEA membership.

John Ferriter at the podium.

IEA'S World Energy Outlook to 2010

The energy industry operates on a long-term basis. Because of the longevity of energy using equipment, the level of energy consumption today has to a large extent been determined by decisions taken many years or even decades ago. Similarly, today's energy supply is largely the result of investments undertaken in the 1970s and 1980s. Thus, in formulating energy policy and making investment decisions, it is important to have a view of possible future developments in the energy sector.

For this reason, the IEA produces its long-term *World Energy Outlook* which provides our assessment of the general direction and possible evolution of worldwide energy trends. Based on this analysis, policymakers are in turn in a better position to assess the consequences of changing, or not changing, the underlying policy parameters.

The 1996 edition of the *World Energy Outlook* was issued in April. The *Outlook* is based on two scenarios regarding the response to rising world energy demand. The cases differ with respect to the assumptions regarding prices and improvement in energy use. Assumptions on economic development have been kept unchanged between the two cases.

The two cases are:

- *Capacity Constraints:* Growth in world energy demand past 2000 will be such that oil prices will rise – to about $25 per bbl. in 2005; and
- *Energy Savings:* Energy intensity is assumed to decline as a result of more efficient energy use. The price of oil is expected to remain flat at about $17 per bbl.

The Capacity Constraints case assumes historic rates in energy efficiency improvements. Trends in past behavior will continue to shape future energy consumption patterns. The moderation of energy demand takes place through a rise in primary energy prices. At the same time growth in energy demand will be too fast for production to keep up without energy prices rising to stimulate additional supply. The growing capacity tightness cannot be satisfied by timely increases in non-OPEC production. Consequently, the balance of production shifts increasingly in favor of a number of low-cost producing countries.

The Energy Savings case implies changes in the way consumers make their choices in selecting and using their goods. The assumptions on additional efficiency in energy use do not involve new technologies or technologies that are not cost effective. Energy saving leads to a significant reduction in the rate of energy demand growth which reduces the need for additional production capacity. Energy markets are assumed to expand appropriately to meet demand growth. Therefore, upward price pressure does not arise.

Oil Price Assumptions

The *Outlook* assumes that there will be no increase in oil prices up to 2000. The assumption of flat prices through the remainder of this decade is primarily the result of significant upward revisions to non-OPEC oil production through the 1990s, mainly for North Sea production. The perception of continuing growth in non-OPEC supplies is a direct result of

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the detailed analysis of short term supply trends routinely carried out in preparing the IEA's monthly *Oil Market Report*.

The upward revision to the projected increase in non-OPEC oil supplies suggests that there will not be any upward trend in oil prices before 2000. This is reflected in the oil price assumptions. The oil price in the *Capacity Constraints* case increases only after 2000, when it is assumed to rise steadily to reach $25 (in 1993 dollars) per barrel in 2005 and remain flat thereafter, as the result of pressure on OPEC capacity. The oil price in the *Energy Savings* case is assumed to remain flat at $17 per barrel throughout the projection period.

World Energy Demand

Regardless of which of the two cases are considered to be more realistic, a number of major elements emerge with which energy policymakers must contend in the medium- and long-term:

- World primary energy demand is expected to continue to grow steadily, and is projected to increase by one-third to one-half between 1993 and 2010 (to between 10,900 and 11,800 million tonnes of oil equivalent - Mtoe). This increase implies an annual average growth rate of from 1.7 to 2.2 percent
- One consequence of growing energy demand is that energy-derived CO_2 emissions could grow by 50 percent by 2010 over 1990 levels.
- Natural gas will account for 21-24 percent of total energy demand by 2010. Rising gas demand is primarily driven by electricity generation.
- With limited scope for increasing the use of nuclear and hydroelectric power in many regions, and the relatively low level of use of renewable sources of energy, primary energy demand will continue to be met overwhelmingly by fossil fuels - by almost 90 percent in 2010.

Oil Supply and Demand

Oil remains the dominant fuel. World oil consumption is expected to increase by about 40 percent by 2010, with most of the increase in consumption taking place in non-OECD countries. By 2010, the OECD will consume only about half of the world's oil, compared to around 60 percent now.

By 2010, the call on OPEC could be nearly 50 billion barrels per day - over half of the world's oil requirements, compared with 40 percent at present (or 28 million barrels per day.)

More than half of the world's energy will soon be used outside the OECD. In 1993, the OECD accounted for over 54 percent of world energy demand. By 2010 this share could be less than 47 percent. Countries outside the OECD, the former Soviet Union and central and eastern Europe, i.e., the Rest of the World (ROW), could account for over 38 percent of the world primary energy demand compared with 27 percent in 1993. Rapid energy demand growth in the ROW also increases substantially carbon dioxide emissions. As an example, we expect China and India alone to account for a larger increase in carbon dioxide emissions between 1990 and 2010 than all OECD countries combined.

The Outlook for Central and Eastern Europe

I would now like to turn specifically to the challenges facing the countries in central and eastern Europe as we look to the next century.

Primary energy demand in the central and eastern European countries - which was about 20 percent of that in western Europe in 1993 - could increase from about 270 Mtoe in 1993 to 360 Mtoe in 2010. After the steep contraction in energy demand between 1987 and 1993 - when aggregate GDP fell by 30 percent - and assuming modest growth until 2000, demand could increase between 1.0 and 1.7 percent per annum over the outlook period. Though this is almost twice the growth that we expect for Western Europe, the region's energy demand by 2010 will not yet reach its peak of the late 1980s.

Most of the increase will be for hydrocarbons. Demand for oil will increase between 1993 and 2010 by 48 to 67 percent. Natural gas will increasingly become a fuel used in newly constructed generating capacity. Consequently, natural gas demand could grow by 60 percent in the *Capacity Constraints* case, where incremental electricity demand will be met primarily by gas-fired power plants. In the *Energy Savings* case, we expect gas to grow only moderately, by 15 percent between 1993 and 2010.

We expect consumption of solid fuels to increase only slightly. Thus, the share of solid fuels in primary energy supply will decline from 52 percent to between 42 and 46 percent. By 2010, coal will still be the main source for electricity production. New capacity will largely be based on natural gas, but nuclear production will remain an important source for electricity generation.

Compared to 1990, carbon dioxide emissions are expected to increase by 2010 by about 7.3 percent in the *Capacity Constraints* case and decline by about 3.4 percent in the *Energy Savings* case.

What does this imply for energy policymakers in central and eastern Europe?

Oil

The significant growth in oil demand results from demand for space heating and transport fuels. Gasoline consumption is expected to rise to almost 11 percent of final consumption in 2010, compared to just over 6 percent in 1993. Consequently, there will be a move towards the lighter end of the barrel.

The majority of central and eastern Europe's oil supplies come from Russia via pipeline through Ukraine and Belarus, as indigenous production by central and eastern European countries is limited. Oil supply to the region will continue to be largely in the form of crude oil. There is likely to be a mismatch between the growing demand for transport fuels and the heavy-end products that can be delivered from Russian refineries. The choice will thus be whether to purchase products in Rotterdam or Mediterranean markets or to purchase crude oil on world markets and refine it domestically.

Both the purchase of products and of crude oil will move central and eastern Europe closer to OECD markets. The establishment of these trade links will require, in some countries, substantial investment in pipeline capac-

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Globalization of the World Economy *(continued from page 7)*

in the European Union results from an insupportably large social welfare system, and rigid labor markets, and penalties on sacking which also penalize hiring. Much is not understood. The German underwriting of *Ossi* prices and wages at five times their real values is in a class by itself.

But whatever the causes, the prolonged stagnation is dangerous. A strongly rising economic tide lifts some segments much faster than others, but so long as nearly all advance, and the few losing out can move over to a rising segment, there is acceptance or at least toleration. But when the lift is weak, there is great uncertainty, fear of the unknown, clinging to what one has, excluding as many as possible. To "save jobs" one puts up barriers to imports, which makes the stagnation worse, which makes the protectionist mood worse. The mild and beneficial North American Free Trade Agreement (NAFTA) is under loud venomous attack. The European Union finds reasons to limit imports from Poland, Hungary, and the Czech Republic despite a natural bias toward free trade with neighbors who may soon be treaty partners.

So as the world economy grows ever more global, the pressures to limit and fracture it also grow. I hope and expect that "aggregate output" - an abstraction poorly defined and nowhere loved - will keep rising. But I will not try to predict the road.

IRANIAN ASSOCIATION FOR ENERGY ECONOMICS
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Report of the 1996 Annual General Membership Meeting and the Year 1995

President Tony Finizza called the meeting to order at 1:30 pm, May 29, 1996 at the Hotel Atrium Hyatt in Budapest, Hungary and introduced Council and past Council members present. He then outlined his broad objectives for the year which included:

- Improving services to members.
- Increasing membership in three areas:
  1. By broadening membership to include more members in the financial, academic and policy areas.
  2. By extending membership coverage in the emerging energy markets.
  3. By widening membership among current country participants.
- Developing and implementing a long-range plan for the Association.

Finizza noted that three-quarters of our members are from industrialized countries and that outside of Japan, only 5 percent of our members are in Asia, the fastest energy growth area. Further, he pointed out that while IAEE has members in nearly 70 countries, only half of those have membership large enough to qualify for affiliate status and only 10 countries have more than 100 members.

Secretary Len Coburn reported that membership was growing at a rate of approximately 4 percent a year and currently totaled a little over 3250.

Treasurer Mitchell Rothman reported that 1995 had been an unusually good year for the Association as a result of the very successful International Conference held in July in Washington, DC. Subsequent to the meeting he provided the following income and expense report for the year and balance sheet for the end of the year:

Income		Expenses	
Dues	$143,000	Admin. & Office Oprs.	$88,000
Meetings	62,000	Publications	102,000
Publications	89,000	Other	11,000
Interest	19,000	Total	$201,000
Other	16,000		
Total	$329,000	Net Income	$128,000

December 31, 1995 Balance Sheet

Assets		Liabilities & Fund Balance	
Cash & Equivalents	$462,000	Accounts Payable	$12,000
Accounts Receivable	6,000	Deferred Dues & Subscriptions	73,000
Total	$468,000	Total	$85,000
		Fund Balance	383,000
		Total	$468,000

Rothman further commented that he had recommended to Council the establishment of a foundation through which the Association could promote energy economics in developing countries and the development of resources for energy economists. He also noted that a committee to develop a definitive proposal had been established by Council.

Finizza noted that coming International Conferences where schedule for New Delhi, India in January, 1997, Quebec City, Canada in May 1998 and Rome, Italy in June 1999. Proposals were now being entertained for the year 2000 and later.

The meeting was adjourned at approximately 2:00 pm.

World Energy Interdependence and OPEC's Policy

*by Rilwanu Lukman**

As we approach the end of the 20th century, there is a distinct upward trend in the globalization of the world's economic interests. The phrase "global village" is creeping into our language, inexorably with the advance of the hi-tech information revolution! The term "village" traditionally refers to the smallest, self-contained community of mankind. As the requirements of communities become more diverse and complex, they resort to broader-based administrative structures. Progressively, their economic affairs operate at the level of the town or city, the local region, the nation and, particularly in the past two decades, the international region. Now we are operating increasingly at a global level.

At the same time, however, as the macro units of operation expand, there is the contrasting tendency towards a sentiment best encapsulated in the whimsical expression of two decades ago, "small is beautiful." This phenomenon is not merely inspired by a wave of nostalgia. It also springs from the realization that many day-to-day affairs function better at the smaller, more personal level.

The energy industry is very much entrenched in this dichotomy. On the one hand, there is the recognition that to realize the true potential for energy efficiency, one must adopt a global perspective. On the other hand, there are the individual, locally induced energy needs of mankind, to prepare food, to keep warm, to travel from A to B and to generate wealth. The ideal global energy equation consists of an incalculable number of smaller, interdependent energy functions.

If, in the following, I concentrate excessively on the international oil market, I make no apology; this is, after all, the principal area of interest to the organization I represent, OPEC. However, the challenges facing the oil market are closely related to those affecting the energy industry at large. Further, I shall focus on the remaining five years of this century - although one cannot, of course, divorce oneself entirely from the longer term.

This five-year period equates roughly to the average lead time for investment in the oil sector. Hence, we already have a pretty good idea about how the oil sector - and, indeed, the energy industry as a whole - will be structured throughout this period. This suggests two dimensions to activities within the industry during this time. First, there is the day-to-day running of an industry whose overall shape and style is expected to evolve only slowly from what we have today. And secondly, there is the planning for the future that must take place during these five years; it is here that we may begin to detect the potential for radical change in the complexion of the industry. There are strong linkages between the actions that satisfy each dimension's requirements. There are also - naturally - conflicts of interest, trading off the present for the future. Throughout, however, the concept of energy interdependence manifests itself.

Keeping the two-dimensional aspect at the back of our minds, let us seek to identify the major influences on the energy industry in the twilight years of the 20th century.

We can begin with the global village, since we referred to this earlier. What will be the extent of the global village and how will it affect the energy industry? As the logical conclusion of the centuries-long process of rationalization and technological advance, one might at first envisage a single, massive global economy, with a concomitant, centralized system of energy supply. However, such are the political, social and cultural allegiances of mankind, as well as the sheer impracticalities of such a monolithic structure, that a rather less grand process of evolution appears likely. This is indeed already taking shape, with the regionalization of the world's principal economic areas into several large, increasingly self-contained groups. Part and parcel of this process is energy supply, and we can, similarly, detect a regional trend manifesting itself here. However, this is a trend, rather than an absolute phenomenon. Clearly, energy supply will continue across regions, since other, basic economic factors will be at work.

The concept of large, regional groupings, with their indigenous energy systems, is not new. The former Soviet Union was one such grouping which lasted more than 70 years; its integrated energy supply system stretched well beyond its vast borders, to embrace neighboring states in Eastern Europe. Up to the end of the 1980s, the FSU was the world's leading oil producer. Its dissolution, however, revealed an oil industry in a state of disarray, characterized by obsolete technology, high inefficiency and poor investment. Oil production and export levels swiftly declined; only now are there signs of a bottoming out. Other branches of the energy industry also suffered rapid, substantial setbacks in the post-Soviet period. Natural gas output fell heavily, although the region remains comfortably the world's leading exporter of this hydrocarbon. Coal suffered a precipitous decline, with present production levels a fraction of those of the Soviet era. The nuclear industry, still rocking from the Chernobyl accident of 1986, was seen to be replete with serious safety problems. Newly independent republics each set about rebuilding their indigenous energy systems; much of this has involved looking outwards from the former Soviet area, into the wider world. The European Energy Charter was set up to assist this process and to attract much-needed investment to the region. The future pattern of energy supply in the former Soviet Union - and its impact on the world at large - is extremely difficult to predict beyond the immediate term, due to the complex of politics, nationalism and other pressures weighing heavily upon the region at the present time.

Much of the former Soviet area's problems stem from its use of obsolete technology. This brings us neatly onto the third major influence, technological change. This is an on-going matter affecting all branches of the energy industry. The pace and extent vary, however. At

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Dr. Lukman and other panelists at the opening session.

the present time, the spotlight is very much upon the rapid rate of technological advance in the upstream oil industry, which has had the effect of greatly extending the lives of existing reserves, as well as lending commercial viability to exploration and production in more remote areas. Nowhere is this more true than in the North Sea, where pioneering recovery techniques have given a new lease on life to reserves which, previously, had been expected to be on a downward trend by now.

Compounding the issue – and, notably, the expense – of technological change is the wave of new rules and regulations being discussed or imposed across the energy world. Many of these have a direct connection with environmental concern. They can be divided into two areas – visible and invisible. The visible relate to the tangible state of the environment and the fostering of healthy, clean and safe life-styles for ourselves and future generations. We in OPEC welcome any sensible, balanced measures taken to achieve these noble objectives. The invisible side is far more tenuous and controversial, as well as being highly politicized. Here we are talking about the phenomenon of climate change and global warming, and the ensuing, purported remedial measures. The most notable of these is the imposition of prejudicial energy taxes. What alarms us is that many countries seem prepared to impose drastic fiscal measures to remedy a supposed malaise, whose very validity is being questioned increasingly by reputable scientists and other experts across the world. If implemented on a wide scale, such taxes would have highly disruptive, hugely expensive repercussions for the world energy mix, as well as the global economy at large. For OPEC's member countries, they would have a devastating impact on our export revenues and, among other things, on our ability to invest in a future, secure oil supply.

The four aspects we have covered so far – regionalization, the FSU, technological change and the environment – all have a part to play in bringing about an economically viable, environmentally harmonious world energy industry for the coming years and into the 21st century. However, they all have one thing in common, and that is the need for investment. This is the fifth of our major influences. It raises so many questions, questions which require answers, and action, as the years unfold. Where does the money come from? How much is needed? Where should it go within the energy industry? What should we concentrate on? Will political considerations continue to outweigh economic considerations? The competition for funds will both be within the energy industry and between it and other industries. Within the energy industry, it will be between different sources of energy. Among the sources of energy, it will be between the different areas of supply. The most blatant case in the oil industry is between investment in the easily accessible reserves, which lie principally in the OPEC area, and the more difficult ones, which lie in the hazardous, remote areas.

Closely related to investment is the issue of pricing – our final major influence. When prices are low, fewer funds will be available for investment. But demand, at the same time, will become higher, increasing the need for investment. In such situations, funds will inevitably be attracted to the areas where you get more for less. If prices are high, then you are liable to get the opposite effect. Furthermore – and this applies particularly to the oil industry – the issue of pricing itself is complicated by the fact that, in the short-to-medium-term, it depends upon more than just economic fundamentals. In today's highly computerized, information age, spot and futures markets play a disproportionate role in determining the price of oil on world markets. This has been a feature of the past decade, and there is little to suggest that it will change, certainly over the remaining years of this century. Everything now happens at such a rapid pace and with greater magnitudes than is either natural or healthy for the market. A mild run on demand in an unexpectedly severe winter, when stocks are already low, will obviously raise prices; but it need not lead to wild overshoots in price, to be soon followed by exaggerated swings in the opposite direction.

So far, I have identified six major influences on behavior in the world energy industry over the remaining years of this century. As I said earlier, we must consider these in the context of keeping the ball rolling in this five-year period, as well as planning for the future. Each of these major influences can be hived off as separate discussion subjects in their own right, but time prevents us from doing this. What we can do, however, is to convey to you how these and other factors have molded our perceptions of world energy market performance in the period up to the year 2000. Here, we use projections from OPEC's *World Energy Model,* reference case scenario.

With the world economy projected to grow at an average annual real rate of 3.4 percent between now and the year 2000, we expect world commercial energy demand to continue to rise, at an average annual rate of 2.0 percent. The most rapid energy growth is expected to occur in the developing countries, at 3.3 percent, and the slowest in the OECD, at 1.5 percent. For the former centrally planned economies, which, for the sake of neatness in our projections, include China, the projected figure is marginally below the world average, at 1.9 percent; effectively, protracted weakness in the former Soviet Union is balanced out by continued rapid growth in China.

Looking at individual energy sources, at a global level, oil is expected to experience the slowest growth rate between now and the year 2000, at 1.8 percent; coal and gas will be neck-and-neck, at 2.0 and 2.1 percent respectively; while

(continued on page 18)

The World Energy Outlook *(continued from page 9)*

ity, refinery upgrading and environmental protection measures, which exceed the financial capabilities of the domestic industry. The restructuring of the domestic petroleum industry and regulatory changes are essential for attracting foreign partners that can provide capital and know-how.

Gas

We expect natural gas demand to grow substantially, due principally to the progressive replacement of coal-fired power plants. The region's own gas production accounts for only about 45 percent of its needs. The majority of the region's gas requirements is met by imports from Russia. The region's own production will likely decline beyond 2000. Consequently, there will be an increased need for gas imports.

Supplies from the former Soviet Union will continue to be the main source of imports. Increased gas demand in central and eastern Europe combined with rising demand in OECD Europe will require new gas transport infrastructure. These will likely make more imports available from the former Soviet Union. Thus, over the longer term, the growth in gas demand will increase the region's dependence upon the former Soviet Union.

Given the growing dependence on imported oil and gas, energy security considerations need to be firmly embedded in the countries' energy policy objectives. Some countries, including Hungary, have already made promising progress in enhancing their emergency preparedness. The majority of these countries, however, will have to substantially increase their efforts. Storage capacity for both oil and gas is generally not sufficient to be prepared for a supply disruption.

Coal

In 1993, over half of the total energy demand in central and eastern Europe was met by solid fuels. Coal is the region's most significant energy source, which explains the dominant role it has achieved over time. However, much of the consumption of solid fuels in the region is accounted for by brown coal.

The reliance on low-quality coal, coupled with a significant presence of energy intensive industry and often inadequate pollution control, has led to severe environmental problems. Governments are required to reduce sulphur dioxide emissions as part of international commitments they are partner to, such as the Convention on Long-Range Transboundary Air Pollution. Finding solutions for cleaner and more efficient energy supply will take time and demand substantial investment in new technology and environmental protection measures. Consequently, the role of coal in the region's energy supply mix will diminish gradually but remain significant.

Restructuring of the coal industry is a necessary condition for modifying the fuel pattern and providing energy more cost effectively. Governments are becoming increasingly concerned with the social costs of scaling down the mining industry. For some countries, the costs of closing unprofitable mines are substantial. Decisions related to the restructuring of coal mines in most cases expand beyond those of simple economics of production. Experience in IEA member countries shows that social welfare support, if required, should be provided directly through the welfare system, not by prolonging high-cost production.

Electricity Production and Nuclear Energy

We expect electricity demand in central and eastern Europe to grow between 1.0 and 1.8 percent annually over the outlook period. Some countries will soon have to make decisions on how to provide new capacity and to replace power plants for which continued operation is uneconomic. Security supply considerations, economics of fuel supply, environmental constraints and social policy objectives will influence the fuel and technological choice.

A particularly sensitive issue is the role of nuclear power. In 1993 nuclear power plants supplied 13 percent of the region's electricity production, but its share in electricity generation is considerably more important in some countries. In Hungary and the Slovak Republic, for example, nuclear power plants produce about 40 percent of total electricity production.

For some countries, nuclear power is an essential strategic energy source. As a result of reduced priority of power generation from fossil-fuel burning plants, the share of nuclear generation has increased in some countries in the early 1990s. We expect that nuclear energy will continue to provide a significant portion of electricity generation, but its average share could decrease to between 10 to 12 percent in 2010.

It is commonly accepted that the nuclear industry in some countries in the region suffers serious design and operational safety weaknesses, faces substantial decommissioning and clean-up costs, and lacks adequate storage facilities for radioactive waste. It is in the industry's interest that any continuation of investment in nuclear energy is fully in line with fundamental safety principles set out by competent international authorities, and that reactors are made acceptable under internationally recognized licensing practices.

The IEA's Role: From Assistance to Partnership to Membership

Intensive IEA cooperation with economies in transition began soon after the collapse of the communist regimes. Initial activities focused on energy policy reviews, drawing on the 20 years experience of the Agency in examining the policies of its member countries. The aim of these first reviews was to provide immediate assistance and advice on the most pressing energy policy issues, and to lay the foundation for the development of sound market-oriented energy strategies.

Follow-up to energy surveys has focused on issues such as emergency preparedness, market liberalization and reduction of trade barriers.

At present, Hungary, Poland, the Czech Republic, Slovakia, and Slovenia have applied for IEA membership. On May 20 Russia also expressed its intention to join the OECD and the IEA. We look forward to developing closer relations with these countries and to welcoming a number of them into the IEA as soon as they have fulfilled the criteria for membership.

News, Oil Markets and the Reality Gap

*by Neil Fleming**

I want to talk today about news. Specifically, I want to talk about the relationship between news and oil markets, between news and oil prices, and between news and the fundamentals which supposedly govern the outright level of those prices.

This is going to be a sort of "state of the nation" speech, in which I'll try and look at where the world of oil journalism currently stands, how it fits into the industry, and what its role is. I don't promise any answers to the questions I am going to put, but I think they are questions worth asking.

Let me start with the absolute basic question: what is news?

There is a curious tendency in the world today, and particularly in financial markets, to think of news as an absolute given - to equate events with reports on events as if there was a one-to-one correspondence of fact to report; as if, in other words, the news reports you read on your screen or in your fax or in your newsletter were perfect mirrors of reality.

This is, rather obviously, a mistake. It's a mistake because, as you all - I am sure know, news-reporting in general is horribly imperfect. News about the energy world suffers from all the problems which plague news about everything else: political bias, lack of perspective, fashionability, sensationalism ... and plain old-fashioned stupidity on the part of reporters.

Yet the mistake persists. And it persists particularly strongly today among oil traders, oil brokers, and the people on the floor of the NYMEX and the IPE.

Picture the scene. A Platt's reporter calls up a trader to ask what is moving prices. The trader replies: "Oh, it's news."

News about what? What sort of news? "Oh, just news." And then that loaded word: "Apparently ....."

Apparently, Iraq is going to sell oil again. Apparently, OPEC is overproducing. Apparently, stocks are very low. Or (my favorite) apparently, it is warmer in the spring than in the winter.

What does this approach to news by the market mean? Where does it come from?

What I believe it represents is an attempt to treat news as data, as a measurable, manipulable quantity which can be used and exploited in the same sort of way as technical trading tools.

The idea is that you, the trader, pre-program your response to a news item. News in, price movement out. Iraq wants to implement UN Resolution 986: sell. Iraq implements UN Resolution 986: buy. Why buy? Because of rule-of-thumb number one: sell the rumor, buy the fact.

News in this model acts as an over-ride trigger to technical trading.

It's a nice idea. The only problem with it is: it doesn't work.

The kind of response the market makes to news headlines is today in fact very similar to its responses to technical indicators. The trouble is that an item of news simply cannot be treated in this way.

News is not raw data susceptible of mechanistic interpretation. It is itself *already*, by definition, an interpretation. When the trading community does its further mechanistic interpreting, it actually and unwittingly transforms news into something quite different - and potentially dangerous.

This is, I think, bad news for people like yourselves whose jobs by and large involve trying to make intelligent sense of events around you, and trying to make accurate predictions about the direction and level of prices over a slightly longer period than 25 minutes.

The market runs, as it were, off meta-news. And as a result, the economist or analyst faces an unpleasant choice. If you choose to analyze the events and news reporting around you in an attempt to establish the underlying truth, you will misread the market.

If you follow market logic in interpreting news, you will potentially damage your ability to understand the big picture.

Take my example of a few minutes ago - the sell/buy responses to Iraq's negotiations with the UN over the past few months. Here is what, as I understand it, actually happened:

In January of this year Iraq's ambassador to the UN told a rather undistinguished group of non-aligned movement delegates in New York that his country wanted a meeting with UN Secretary General Boutros Boutros Ghali. He said Iraq was trying to contact Boutros Ghali to talk to him about UN Resolution 986.

This as you know is the resolution which allows the sale of Iraqi crude for humanitarian purposes.

The market plummeted.

Clearly here was a fresh initiative from Iraq aimed at resuming limited oil exports.

Wrong. It wasn't a fresh initiative, it was part of an ongoing one. The only reason Iraq was "trying to contact" Boutros Ghali was that he was out of town. The only reason the ambassador brought it up was that somebody asked him. The drama was artificial.

OK, then. Clearly Iraq had made up its mind it wanted to implement UN986.

Wrong again. The main thing on Saddam Hussein's mind at the time was trying to persuade the UN to change UN986, to get rid of the contentious clauses about food distribution in Kurdish areas. Again, as late as mid-April this year, Iraqi contacts were indicating the chances of Iraq accepting the resolution at all were less than 50-50. Accepting UN986 is a gamble for Saddam Hussein, since it leaves him, potentially for all time, at the mercy of the UN Security Council. Accepting UN986 may even be his downfall.

So what we witnessed in January, in fact, was an example of what I should like to term "News Creep."

This is an expression stolen from the bombing raids of the Second World War - "creepback" was the tendency of successive planes in an air raid to drop their

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*Neil Fleming is Editor-in-Chief, Platt's *Global Alert*, London, England. These remarks were given in response to his receiving IAEE's 1995 Journalism Award at the 19th IAEE International Conference, May 27-30, 1996 in Budapest, Hungary.

News, Oil Markets... *(continued from page 15)*

bombs earlier and earlier over the target. Planes at the front of the raid aimed at the marker flares. But planes at the back typically dropped their bombs a mile or two, or three, further back than they should.

News Creep is the tendency of oil markets to react earlier and earlier to things which have not happened yet.

A really startling example of News Creep occurred just last week, on the day on which Iraqi chief negotiator, Abdul-Amir al-Anbari, signed the memorandum of understanding at the UN in New York clearing the way for a return of Iraqi crude to export markets.

The "news in-price movement out" school of trading had, for short-covering reasons, long since determined that the actual signing of the deal should be a buy trigger. But on the actual day, the screen headline which sparked the start of a $1.50 price surge, filed at 1308 GMT on May 20th, was this:

Anbari has instructions from Baghdad: Iraqi Mission.

It was a Platt's *Global Alert* headline, as it happens, but that is not a boast. Instead, it's an admission of sorts. The fact is that we in the newsroom at Platt's had no idea the market would respond in the way it did, which was to rocket through the roof. Why should it? News Creep.

Now the question is: are phenomena like this important? Do things like News Creep mean anything, or are they just amusing froth at the surface of the market, irrelevant to the deep swell of the economist's beloved *fundamentals*?

I'd like to argue that they are important, and indeed that they have a profound influence on some market aspects which are traditionally seen as fundamental.

Stock levels, as everyone here knows, are at historic lows in the United States. A central reason for those lows has been the oil companies' perception that crude supplies this year will comfortably outrun demand. A central reason for that perception has been the belief, or the feeling, or the superstition, which has been in place for about 18 months to two years now, that Iraqi oil will again flow in substantial quantities.

That belief or feeling or superstition was not the result of analysis: it was the result of News Creep. Analysts and economists (and even journalists) have been pointing out till they were blue in the face that the President of the United States of America cannot afford to lift sanctions against Iraq in an election year. Yet the market took the possibility seriously, probably holding crude prices a dollar or two below where they would otherwise have been for the past two years; OPEC took the possibility seriously, freezing its production ceiling at 24.52-mil b/d for a whole three years while it sat and waited for Iraq's return, and the oil companies took it seriously, and ran down their stocks.

Today, with Iraq's deal signed last week, I'm prepared to bet that 9 out of 10 price forecasts for the rest of 1996 predict sharply lower prices in the third and fourth quarters of the year. By sharply, let's say $3-4/bbl. below current levels. Now these forecasts may very well be right. But I can't resist pointing out that:

1. The memorandum of understanding signed with Iraq does not even include an aid distribution plan. There is no guarantee the UN will agree to the plan which Iraq devises; and
2. The UN has not even begun drawing up procedures for dealing with the sale of Iraqi crude.

The implication of these two little facts is that it could be August or September before the UN is even ready to let the Iraqi exports start rolling. It will then be November or December before the exports crank up to half a million barrels a day. Is that really so much oil that it's worth the gamble of not re-stocking this year? I don't think so. I think my friend News Creep is at work.

Now, the origins of news distortion in the oil market are a little obscure. Things were not always this way. Or so some would argue.

What appears to have happened over the past 10 years or so, however, is that there has been a marked structural shift in the oil news media.

When I joined Platt's for the first time, in 1985, the oil news world was dominated by newsletter "bibles": *Petroleum Intelligence Weekly, The Middle East Economic Survey*, Platt's *Oilgram News*. These were the places where the industry looked for news, looked for insight and looked for scoops. At that time, as an aside, seven or eight major newspapers plus two or three TV networks were sending correspondents to OPEC meetings.

Eleven years on, the industry is dominated by four screen news services: Platt's *Global Alert*, Reuters, Dow-Jones Telerate and Knight-Ridder Financial. The weeklies and dailies retain an honorable place as bringers of analysis and in-depth reporting. The number of actual reporters at OPEC meetings has dropped by two thirds. But the volume of news *flowing* from each OPEC meeting has probably doubled.

The engine which drives the market, in other words, has radically changed.

There is, self-evidently, a link between this change and the development of the oil market's own unique approach to news. Screens by their nature are vehicles for sound byte-style news. Screen news is ephemeral; it is headline driven; and while all screen news services make much of their impartial, factual reporting, screen news is, in fact, potentially more manipulative than an analytical editorial.

It is a fact that most traders looking at a news screen read only the headline on 80 percent or 90 percent of the stories passing before them. As a result the desk editor's choice of words in composing the headline becomes all-important. The editor's decision to file a "newsflash" or not takes on godlike significance.

In the course of the Iraqi saga over the past few months, for example, I have had calls from irate traders demanding that we assign newsflash status to every single Iraq-related item. I have also had calls from equally irate traders demanding to know why we were putting out all these flashes.

The fact is that the news that passes across a screen is selective, and that very selectivity makes it far from impartial.

To make matters worse, the selective pressure on the editor comes directly from the market's desire to be

entertained by one-liners. At Platt's, I would claim, we do our utmost to resist the temptation to sensationalize. But even the soberest headline, on the wrong day, can trigger unlooked-for market response. If the traders are feeling bullish that day, then bullish is how your headlines are going to look to them. What develops is a potentially self-feeding cycle. The more focused the market becomes on a single issue, the more radically it is affected by news about that issue. And the more it is affected, the more news is generated, as a secondary wave of headlines comes over the hill talking about how Brent is up a dollar on reports of whatever the news may be.

This phenomenon, I believe, has contributed in quite a big way, to OPEC's inability to operate as an effective organization in recent years. The market's obsession with OPEC as a source of trading triggers has led to an extraordinary level of expectation attaching itself to each and every meeting OPEC holds. OPEC's frustration is that in recent years it has declared itself to be a guardian of market stability. But its very own meetings have unwittingly become the biggest single focus of instability around. Logically, it's best bet in this situation is to disband the organization altogether.

A vast reality gap has opened up between what OPEC does, the real-life effects of what it does, and what the market expects it to do. When it meets next week in Vienna, the weight of expectation is going to be huge. Everyone is waiting for OPEC to "do a thing" - anything - to take into account the return of Iraq to oil markets. Chances are, it will do nothing at all, and will argue persuasively that the demand fundamentals are such that nothing needs to be done. Will this impress the market? Nope.

The state of news as a component in the oil market, then, looks a little bleak from where I stand. On the one hand it has more influence over outright oil price levels than it ever used to. And on the other, it is suffering a debasement of its value as information.

But it's not all bad. Competition between news services is probably more intense now than at any time in history. News is delivered faster and in greater quantities than at any time before. The analysis is still there - even on the screen services. And because the raw news is reaching the user faster, the specialist weeklies and monthlies have the leisure to develop stories and get behind the scenes more than ever before.

Where we go next will, I think, depend on the market's appetite for news. In the minds of some, we face a brave new world of instant, cheap, Internet-based information which will elevate the role of news still further. Personally, I doubt it. There is such a thing as too much of a good thing. And if the decisionmakers of the oil industry set out to re-vamp their approach to trading, or if, in the next couple of years, we find ourselves locked into a permanent supply-side deficit, the need for news may evaporate as quickly as it has built.

A month or so ago, a Norwegian trader who shall be nameless came into the Platt's office in London. We got talking, and I asked him what he thought of Platt's *Global Alert*. "Oh," he said. "We had that on trial. But we canceled it. There was too much news."

OPEC's Policy *(continued from page 13)*

hydro and nuclear, combined in this analysis, will grow fastest, at 2.3 percent. However, there are inherent regional biases in these figures, with the former CPEs inflating the figures for hydro/nuclear, at 3.5 percent, and the OECD and DCs majoring in gas, at 2.2 and 4.0 percent respectively. Relatively speaking, oil demand growth fares badly in the OECD, but performs quite well in the rest of the world. Weak growth is expected for gas in the former CPEs and for hydro/nuclear in the OECD.

However, every energy source will experience an absolute rise in demand, in global terms, during this period. At the end of it, oil's share of the world energy mix will still be the largest, at 39 percent, well above 29 percent for coal, 21 percent for gas and 11 percent for hydro/nuclear.

Thus, our reference case projections indicate a steadily evolving world energy scenario, with continued all-around growth, pronounced regional characteristics and only marginal changes in the world energy mix in the final years of the 20th century. One cannot really expect much more than this, in the way of change, in a comparatively short period, unless there is a major political or economic upheaval or a natural catastrophe – and who has the vision to predict these?

As we can see from the above figures, most of the energy the world uses today is based on finite resources. These are the major commercial fossil fuels – oil, gas and coal. We can only use them once. However abundant one believes these resources to be – whether they have reserves-to-production ratios of around 50 years or, with improved technology, 60 or 70 years – the fact remains that they will not be here forever. It is the responsibility of all of us to optimize our use of them while they are still around in commercial quantities. In this instance, I am referring specifically to the oil industry, though a similar situation prevails with the other fossil fuels.

The situation is somewhat different for the other two major commercial forms, nuclear and hydro. Nuclear has been heavily discredited in recent years on the grounds of safety and cost. I do not believe the present forms of nuclear fission will ever regain the full confidence of the public in many parts of the world. Hydro has obvious geographical restrictions, as well as serious environmental shortcomings. There are no other renewables around at the present time which have the potential for commercial viability on a large scale in the foreseeable future.

The overriding message that comes from all of this is the notion of interdependence in the energy world. It is a world full of requirements and availability. The principal issue is to decide how to match one to the other. Choices must be made, both as part of our daily routine and with the future in mind. There is easily enough energy supply around in its diverse forms to meet the world's needs – certainly for as long as any reader. is going to be alive. The next two or three generations have little need to worry, either. By the very long term, the world is expected to have developed other forms to commercially viable levels. Here we are stretching our sights to the 22nd century, and not the next five years, the period with which we here are mainly concerned.

In OPEC, we take the issue of interdependence in the international oil industry very seriously. It is enshrined in the OPEC Statute, which dates from the earliest days of our Organization, three and a half decades ago. Our Statute is built upon the principle of achieving lasting order and stability in the oil market. It envisages producers, consumers and investors performing their respective roles and receiving equitable returns. However, to reap the fruits of interdependence, there must be wholehearted cooperation among these parties. This has been our overriding message since the early 1980s. Much progress has been made in recent years.

The pinnacle of this progress is an event which has become an annual occurrence during the course of the 1990s. This is the International Oil Producer-Consumer Conference. The first of these meetings, held in Paris in 1991, owed much of its impetus to persistent pressure by OPEC over the years to bring together, under one roof, many of the oil industry's leading officials and experts. The aim was to discuss leading topical issues affecting the smooth operation of the industry. By last year, when the Conference was held in an OPEC member country, Venezuela, for the first time, the agenda had broadened significantly although it still did not include what we consider to be the most important issue of all, oil pricing and production.

This issue is best expressed in the context of the following anomaly - the global imbalance between reserve strength and output. OPEC's member countries hold three-quarters of the world's proven crude oil reserves, and yet account for only two-fifths of its output. For as long as such fundamental anomalies remain, the whole prospect of a steady, untroubled evolution of the international oil market is compromised.

In the light of all this, OPEC's policy regarding world energy interdependence is clear. As an Organization which has had more than its fair share of ups and downs in the oil market in recent decades, we seek to encourage dialogue and cooperation throughout the energy industry. This is an indispensable requirement if we are to benefit the most from the world's finite energy resources in the future. We play our part in our particular arena, the international oil market, through our production agreements, our monitoring of day-to-day developments, our specialist research facilities and our general involvement in energy fora. But we can only go so far, even in the oil industry, despite our overwhelming reserve strength. We also need the constant, unwavering support of the other main parties. Once order and stability become established in the oil market, this will provide the foundation for a more robust and effective global energy industry.

In the final analysis, therefore, there is no escaping the fact that we all have a part to play in bringing about an orderly supply of energy to the world over the coming years and into the 21st century. Mankind cannot afford to have its energy supply disrupted by sectoral interests, as has happened so often in the past. There are other major international issues to be resolved, such as the escalating world population, which needs to be fed and housed and kept warm. We must all strive to achieve an optimal energy policy into the 21st century, that satisfies our individual requirements, as well as being beneficial to the world at large.

World Petroleum: Opportunities and Challenges; The Role of the Energy Economist

*by Paul Tempest**

The question I would like to address today is, I imagine, the most fundamental issue facing every energy economist. The question is: Given the likely prospects for the petroleum industries, what chances has each of us of earning a living from energy economics?

First, I would like to explain briefly what the WPC Permanent Council and World Petroleum Congresses set out to do, so that you understand their role over the last 63 years as a top management forum, an engineers' network and a channel for technology transfer.

Second, I will summarize the focus of recent Congresses and what I think, is currently exciting and preoccupying the Executive Boards of the leading companies. These I have boiled down to 10 points.

Finally, I try to answer the question of where the energy economist might fit into these new developments.

WPC Objectives

The first WPC Congress was in 1933.

At that time, there was a great need for agreed standards and specifications in the oil industry. Basic WPC definitions of a proven, probable and possible barrel of oil in the ground negotiated at that time and at intervals since then, hold today. The Society of Petroleum Engineers (SPE) and the WPC have been working on an updated version of these definitions to be announced at our next Congress in Beijing in October 1997.

The second purpose from 1933 has been to make at each Congress a regular comprehensive review of all new technology in the industry and its impacts. The top Research and Engineering Vice-Presidents and equivalents on our Program Committees, mainly from Shell, Mobil, BP, Exxon, Total, Texaco, Chevron; also PDVSA, Petrobras, Statoil, Pertamina and Saudi Aramco pick 21 Forum Chairs and Speakers for 10 major Review Panels. The Chairs then each pick 4 or 5 speakers whom they consider the leaders in the field – none ever refuses a WPC invitation. So at present, our Program Chair is the President of Exxon Research and Engineering and our President (and former Program Chair) comes from heading the main Shell Research Laboratories in Amsterdam, our 21 Forum Chairs are widely recognized as the leading authority in each specific field.

So we end up with the heads and top management of almost all major oil companies, a large number of oil and energy ministers, 100 selected speakers of very high quality, and 200-300 poster presenters. The proceedings summarize the discussions and carry the final texts of the papers. They cost US$1,200, and we sell a large number of sets.

The third purpose of the WPC, therefore, is a valuable network. Each of our 43 member countries, all major countries, have WPC National Committees based in almost all cases on an Institute of Petroleum, such as the American Petroleum Institute (API) in the U.S., or the Institut Francais du Petrole (IFP) in France. Ten of these Institutes have more than 1000 employees.

Each member state has three representatives on the WPC Permanent Council and each member state has one vote – the vote of Hungary as in our recent votes to select the Congress venue for the year 2000 is worth exactly the same as the vote of the United States or Russia. Hungary, incidentally, sent its own impressive delegation to the first WPC Congress in 1933 and plays a valuable role in our various committees.

That brings me to a key feature of the WPC. It has always been *totally politically independent*. No one country or group of companies can dominate. London was chosen in 1933 because it was neutral ground between Russia, the Middle East and the USA. Its prestige therefore rests on:

- Technical excellence of its papers
- Political neutrality
- A valuable network
- The work of its technical committees – standards, the environment, development, etc.

A word about the next Congress in Beijing. We expect this to be very large and preparation is well advanced. The Chinese have given us the Parliament Buildings in Beijing for the Opening Ceremonies with 10,000 seats to be filled in the Great Hall of the People. They have promised, as is the norm at WPC Congresses, the Head of State for the opening and also, concurrently, the largest oil and gas supply industry exhibition ever mounted in China. So I expect those 10,000 seats to be filled (our previous highest attendance was 9,500 in Frankfurt in 1963.)

The Focus of Interest of the WPC

In 1991 the WPC convened in Buenos Aires. Its discussions were structured on:

- the changing refinery configuration and product slate necessary to meet new environmental standards
- the fear of a projected global investment shortfall
- regional supply/demand imbalances and the implications for transportation and international trade (aging tanker stock, new gas trunk lines, etc.)

In fact, all the excitement centered on President Carlos Menem's announcements at the Congress concerning the liberalization and privatization of the Argentine petroleum sector.

In 1994 we met in Stavanger, Norway. Once King Haretid had opened the proceedings, the first speaker was the Norwegian Prime Minister, Mrs. Brundtland, and she carried two strong messages:

1. The need (much contested by parts of the petroleum

(continued on page 20)

* Paul Tempest is Director General, World Petroleum Permanent Council. This is an edited version of his remarks at the 19th IAEE International Conference, May 27-30, 1996 in Budapest, Hungary.

The Role of the Energy Economist *(continued from page 19)*

industry) for global environmental standards – emissions, spills, other pollution, etc, and
2. The need for a tighter fiscal system in the North Sea – also much contested by the North Sea operators.

For October 1997 in Beijing, we already have our 21 Key Forum Topics defined, our Chairs are in place and almost all of our speakers have been selected. The focus is very much on the Pacific and Asia/Pacific growth, the role of China and the steadily rising demand for oil and natural gas from that region, and how that might or might not be satisfied. On new refinery technology we have five key forums and the same number on new upstream technology, so that indicates where the weight of interest is being put at present.

What is Preoccupying and Exciting the Industry Today

Looking at the industry from the perspectives of the WPC – that is from the view of top-management and the top-engineers in the business – I sense a strong undercurrent of excitement and optimism and an exploration of new ideas and new areas of activity, particularly in the Pacific Area:

1. *Oil prospects*: after a long period of stagnation, the industry is beginning to plan for a major upturn in demand, including a doubling of Asian oil imports – from the current 10 mbd to 20 mbd before 2010 with perhaps another 5 mbd in Latin America and Eastern Europe and 5 mbd elsewhere if more demand emerges in North America and Europe.
2. *Gas growth*: the prospects for natural gas are for steady growth with excitement focused on a number of major pipeline and LNG projects (e.g., Bolivia/Brazil gas line and Qatar LNG.)
3. *Structural change*: the industry is preoccupied with structural changes in the market – the switch of Atlantic light sweet crudes to the Pacific markets, refinery investment in the Pacific area, refinery reconfiguration elsewhere.
4. *Improved finances*: the financial performance of the industry appears to have bottomed out; 1995 profits have been encouraging; refinery margins have improved; the stock market valuation of the industry is buoyant.
5. *New joint projects*: deregulation and privatization are providing a flood of new joint project opportunities worldwide.
6. *Cost-cutting*: rationalization and widespread sustained cost-cutting have delivered a very strong impetus to new technology and greatly enhanced efficiency. Mercifully, we seem to have reached a period of temporary respite from the accountant's ax.
7. *Petrochemicals recover*: the key petrochemicals sector of the industry is indicating a strong cyclical return to profitability.
8. *Environmental issues*: at last the industry appears to be recovering its nerve after a severe mauling by the environmentalist lobbies. The industry is now busy demonstrating good practice, mobilizing the arguments for a rational trade-off between sustaining new investment and growth and observing meticulously agreed standards of environmental protection.

Two further points:

9. *Contracting*: the problems of abandonment of offshore structures combined with strong pressure for further cost savings, has set the entire industry thinking about the minimization of risk. Not only is offshore construction largely subcontracted to the supply industry and transportation by tanker or pipeline to third parties; the offshore installations of the future may possibly be sold to new, independent entities and leased to the operating companies. Even the operation of production facilities may be performed by contractors. Theoretically, but unlikely in the short-term, the majors upstream could end up as little more than holding companies.
10. *Asset trading*: Downstream, competition from hypermarkets for the gasoline and diesel market is beginning to sink in. I foresee much more vigorous trading of downstream assets and market outlets between the major companies which will be the counterpart of the new upstream asset trading and leasing.

In summary, there is very considerable optimism about in the petroleum industry. I would go as far as to suspect it of complacency. I have three major reservations:

- Supply security,
- Assumptions regarding privatization, and
- Multinational/OPEC convergence.

Supply Security

Given that the bulk of incremental oil demand can only be satisfied by increased supply from the Gulf states, I hope that the lessons of the past will not be forgotten. Why should those Gulf states continue to increase capacity and production when a tightening oil market can deliver the same benefits through rising prices and enhanced revenue? There must be some point when the OPEC leaders begin to call the tune and when they begin to put a brake on production increases.

I never fail to be surprised to hear that new joint projects are based on flat oil-price assumptions of US$15-20 real (Brent) or US$20-25 (WTI) over a 20 year horizon; extreme prudence perhaps or tacit acknowledgment that the balance of probability is for upward pressures to come, strengthened by the average of three or so major supply shocks over each 20 year period in recent history.

Assumptions Regarding Privatization

The thesis that privatization of state energy entities opens up hitherto inefficient industries to global market forces and leads to greater efficiency was argued most fervently in the United States and preached by the World Bank/IFC. Certainly, it seems to be an effective device to decouple a state oil or gas company from domestic oil price problems, where, for political reasons, the state oil price has been kept low and out-of-contact with world prices. Yet the follow-up argument that privatization of all parts of the energy sector will automatically produce economic efficiency is one I find very difficult to accept. I would point you to most parts of the developing world and some of the industrial world where governments are determined to cling to what they regard as the dominant heights of

the economy and where, often quite rightly, many regard privatization, as jiggery-pokery designed to shift economic rent and capital value into the hands of a few individuals or a very small sector of the financial community.

Multinational/OPEC Convergence

The currently popular prediction of multinational/OPEC convergence based on the parallel interests of the multinationals as a group and the group of leading OPEC countries regarding the scale of oil production and the level of oil-prices, is also one where I have major reservations. The spread of investment by the multinationals is so worldwide that I regard multinational/OPEC convergence as a non-issue. In any case, at the end of the day in any major energy supply panic, even the multinationals have to listen very carefully indeed to what their parent and host-governments tell them and multinational/OPEC convergence assumes that OPEC unity can again reconcile, at least temporarily, the fundamental political differences between the leading OPEC states.

The Role of the Energy Economist

Where does the energy economist fit into this picture? Certainly, opportunities for employment within the major companies have, over the past five years, been very bleak, indeed, as corporate planning departments have been delayered, downsized or stripped out and the training, planning evaluation, public affairs and orientation functions have been very largely out-sourced. There has been plenty of work outside for consultants and short-hires on projects but little inside the industry at its heart.

The petroleum industry is very largely managed and directed, with high professionalism, not by energy economists but by engineers - those engineers who have been most successful in their companies, lifelong servants of their companies and, as they see themselves, first and foremost, engineers - with a broad range of specific interest. As engineers, they are well attuned and most happy constructing machines, installations, systems, etc., using teams of experts which they tend to disband as soon as a project is complete.

When I look at the key issues currently being faced by the top managers of the petroleum industry worldwide, I come firmly to the conclusion that these issues have very little to do with engineering, geology or even product sales, and a great deal to do with energy economics, public and government acceptability and a market understanding of commercial, financial and geopolitical risk. These are areas where the well-trained and experienced energy economist can make a major contribution. In a new phase of industry expansion, the top managers will quickly recognize their needs. I, therefore, conclude my remarks with a high-probability prediction reached after some reflection:

As the petroleum industry moves into a new phase of expansion, and period of profitability, there will be plenty of work in the field of energy economics for the foreseeable future.

Scenes from the Budapest Conference

Award winners Neil Fleming (left) and Yves Smeers (2nd from right) with president Tony Finizza (2nd from left) and past president Jean Masseron (right). Fleming was presented with the 1995 Journalism Award and Smeers the 1995 Outstanding Contributions Award.

Laszlo Lengyel (l), Program Chairman, and Tamas Jaszay (r), Conference Chairman, smiling at the successful conclusion of the meeting.

Coal: The Abundant and Competitive Fuel for the 21st Century

*by Robin J. Bennett**

As economists and businessmen, I know you will fully appreciate that the evaluation of the supply prospects for anything as important as a source of primary energy must take into account not only the short and medium term unit price, but considerations of *long-term* availability, reliability, flexibility and security of supply as well as total costs of production and utilization. Today, environmental factors must also be examined.

I hope to demonstrate that coal is abundant, secure in supply, cost competitive, flexible in its applications and freely available to all parts of the world; and that this *traditional* energy source, so long associated in Europe and elsewhere with the first Industrial Revolution and with grime and pollution, is now and will become even more the *fuel of choice* in the next century.

The Current Position of Coal in the World

In 1993 – the latest year for which the figures are available – primary energy demand in the world was around 8000 million tons of oil equivalent, (Mtoe), of which solid fuels – predominantly coal – accounted for 2300 Mtoe, or 29 percent.

Production: Total world production of *hard coal* in 1995 was around 3590 million tons, an increase of around 1 percent over the previous year.

The biggest producers are:

	Mil. tons Per Annum
China	1292
USA	849
India	233
South Africa	197
Australia	196
Russian Federation	156

Other major producers include Poland, Kazakhstan, Ukraine, Germany, the U.K. and Canada. More importantly, there are new, rapidly growing producers such as Indonesia, Colombia and Venezuela.

Trade: At present, more than 85 percent of the world's coal production is consumed in the country of origin, but world trade in coal has been growing rapidly over the last 20 years. In 1995 it increased by 8.9 percent to 446 million tons.

The trade in thermal coal has been growing at an average annual rate of 7 percent over the past 15 years to reach its present level of 265 million tons, and in the future will continue to grow at the same rate, or faster. Coking coal trade has by contrast remained fairly static for several years at close to its current level of 182 Mt.

The big three exporters are Australia, South Africa and the USA, with a number of other countries rapidly expanding their share of the growing market. The ranking order of exporters is different according to whether steam or coking coal is considered.

Forecasts for Future Production and Trade

By the year 2010, coal production and use are forecast to rise by 47 percent to about 5300 million tons, and by the same year, world trade in coal will have nearly doubled – to 850 million tons. In East Asia alone, excluding Japan, additional imports of around 150 million tons will be required.

The Abundance of Coal Supplies

If we look at the picture of world coal reserves, it is easy to see how the expansion predicted above is possible and, more importantly, sustainable well into the next century. The proven reserves of hard coal are between 3 and 4 times as much as the reserves of oil and gas put together. These comparisons are based on proven and *economically recoverable* reserves, using existing technologies and without taking into account developments which could increase the recovery ratio and/or can enable inferior quality coals to be used efficiently in the future.

These figures ignore brown coal and lignite, of which the reserves are equally massive. These fuels are not normally traded over any appreciable distance because of their low calorific value per ton, but new mining techniques leading to extremely low costs of extraction – under $4 a ton in some cases – may make exports viable or may justify the generation of electricity on the mine site and its subsequent long distance transmission.

Security and Flexibility of Supply

The above figures clearly demonstrate the abundance of coal, but of equal importance are the security and flexibility of supply that coal offers.

Distribution: Unlike oil and gas, coal is produced in around 50 different countries, spread over all 6 continents. The reserves also are distributed widely in all major regions of the world. The comparison with natural gas in particular is stark.

Seventy percent of all natural gas reserves are located in the Middle East or in the former Soviet Union, where they mostly lie more than 4000km from their major domestic and export markets. The reserves of coal are widely distributed around the world and the major exporting countries have well established and politically stable governments.

Transportation is also secure. Ninety-five percent of internationally traded coal is shipped directly through international waters from the exporting country to the consuming country. Long distance gas pipelines, by contrast, may have to cross several other states lying between the exporter and the consumer. Moreover, if a single coal-carrying vessel sinks, it might cause a temporary problem for one consumer, but if a pipeline is fractured or closed for any reason, it could be a disaster for the whole market.

Competition: Security of supply is further enhanced by the intense competition which characterizes the international coal market. If one coal supplier experiences production or even financial difficulties, many others in the same or in other regions can replace the lost tonnage.

The coal industry has no equivalent to OPEC – prices are freely determined in the market place, which has ensured price stability for 30 years.

Flexibility: Modern coal production techniques enable producers to increase or temporarily decrease production at

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short notice without major difficulties. Unlike the traditional deep mine production in western Europe and parts of North America, where extraction takes place below the water table, and mines must be either kept open or totally abandoned, it is quite feasible to cease production for months or years at the modern, open-cast mines in other continents, without damaging the capital equipment or jeopardizing the accessibility of the reserves. This ability to adjust capacity to changes in the market, together with the ability to stock-pile coal at the mines, ports or consumers' site, facilitates flexible supply contracts.

There is no such thing as a 'take or pay' contract in the coal industry. In this way consumers can adjust their demands according to their needs and their finances, both in the short and medium term. The disequilibrium which arises from time to time in the gas supply industry is not a problem for today's coal industry.

Coal is Competitive

I hope that by this point I have demonstrated to your satisfaction that coal is an abundant, secure, reliable and flexible source of primary energy. But for economists, I realize that this is not enough! You will want to hear that the final cost of the coal – both the purchase price and the capital costs of the equipment to burn it – will not be uncompetitive now, or unstable in the future.

Mining Costs: Coal mining is capital intensive and, relative to oil and gas, is also labor intensive. However, market pressures and technical innovation have enabled the industry to reduce the cost of coal in real terms over the last twenty years. This has been achieved at existing as well as in new mines.

First, labor productivity has increased steadily in all major coal-exporting countries, particularly since 1980. These improvements have been made both in countries with high wage costs – Canada, USA and Australia, and with much lower wage costs – Colombia and South Africa. The labor cost per ton of output increased somewhat up to 1990, but is now trending downwards again as the rate of productivity growth exceeds wage inflation – this is particularly noticeable in Australia and the USA.

Of course, the development of new mines and new coal measures has been the key contributor to the improvements in labor productivity and the reduction in the total costs of coal. In the oil and gas industries, new reserves tend to be found further from the markets, and/or deeper under the ocean, and so require major capital investment on equipment and pipelines. Frequently extraction costs are higher. By contrast most of the recently established and fast developing coal fields in places such as Colombia, Indonesia and Australia enjoy extremely favourable geological conditions. Normally, extraction costs, even including infrastructure costs, are lower than in existing coal fields.

Much of modern coal mining is more like an earth removal operation than a traditional underground mine. Not only is the coal easily accessible, with relatively small amounts of overburden – a low strip ratio – and, therefore, high yields of saleable coal, but the seams themselves are extremely thick.

Transportation costs: While the capital and current production costs and hence ex-mine prices of coal may be expected to continue to fall in both real and money terms, it is more difficult to secure economies in transportation costs, particularly where rail transportation is used to bring the coal from the mines to the ports.

Ocean freight costs, while fluctuating considerably with market changes in the short-term, have tended to decrease or at least remain stable over the last 20 years. This is due partly to the excess shipping capacity available and partly to economies of scale from the increase in size of bulk carriers and the terminals at which they are loaded and discharged. Similarly, the handling costs of coal at these terminals has been brought down by revised work practices and massive investment in new equipment.

Nonetheless, transportation and handling costs together account for more than 50 percent of the total CIF value of coal and an even higher proportion of the final works delivered price, depending on where the end-user is located relative to the port. For example, coal loaded into rail cars at a mine in Australia for $20 a ton, faces a total of $10 for rail and loading costs and $14 ocean freight to Europe, so that 55 percent of the CIF price of $44 per ton is transportation. For some American producers the situation is even worse – an ex-mine price of $16/ton may result in a CIF Rotterdam price of $43, of which 62 percent is transport.

Some new coal fields are close to export ports which are, of course, built to the highest standards and enjoy the lowest costs, but transportation will remain a significant constraint on the ability of the coal industry to reduce its prices to the consumer in the long run.

Average Prices: The delivered prices of imported steam coal in the major markets of Europe and the Far East have not changed significantly since 1980. In Italy, for example, the delivered price to power stations averaged around $60 per Ton of Coal Equivalent (7000 kCal/kg), roughly equivalent to oil at $85 per ton, or $12 per barrel. During the period the price fluctuations were seldom more than $10 per Tce. At the same time natural gas prices to Italian power stations ranged from a high of some $160 per Tce to a low of about $60 but in only one year (1988) did it fall below the coal price and was on average some $20 or 33 percent higher.

The current downward trend in gas prices, based on a temporary surplus of gas, may tempt some power utilities to move to gas for new and replacement power stations, especially as capital costs are less. The long-term cost trends are likely to point in the opposite direction.

Coal Demand - the Electricity and Steel Industries

Electricity: Nearly 60 percent of all coal mined in the world is used for electricity generation. This proportion is predicted to remain stable or to increase in the world as a whole over the next fifteen years, despite the major inroads into coal's share of the electricity market made by natural gas, particularly in Europe.

Looking further ahead, we may see the share of coal going either way. If major developments of renewable energy sources become available at a sensible cost towards the middle of the next century, the share of all fossil fuels, perhaps coal in particular, in the electricity generation market will tend to decline, the more so if the theory of global warming is widely accepted and pressure to reduce greenhouse gas emissions becomes part of government policies world-wide.

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Coal *(continued from page 23)*

An alternative possibility is a rebirth of nuclear power on a much lower cost base than hitherto, and with the problems of waste disposal and public acceptability solved.

However, by that time, the total amount of coal used for electricity generation will have increased in line with the total demand for power. Coal production will have increased to more than 50 percent above current levels, and coal trade more than doubled.

Iron and steel: Although only about 13 percent of coal is currently used in the world steel industry, 70 percent of steel production is dependent on coal, mostly after its transformation to metallurgical coke. The death of the blast furnace/coke oven route for iron and steel making has been predicted ever since I joined that industry in the early 1960s, but the much vaunted new technologies for the direct reduction of iron ore have so far made only a negligible dent in the steel industry's requirements for coal. There has been a considerable reduction in the amount of coal used to produce a ton of iron, but this has been achieved largely by the introduction of Pulverised Coal Injection (PCI), which uses a cheaper steam coal to replace some coking coal. Overall, every ton of steel produced from iron ore rather than from scrap requires about 630 kg of coal of one sort or another. The dramatic sight of coke being discharged from the ovens will still be a feature of the steel industry for many years to come.

Environmental Factors

Coal suffers unjustly from a very bad image - the environmental effects of coal mining and particularly of coal use were extremely damaging in the past, but most of the effects are now in the past.

Mining: The results of mining were all too often despoliation of the landscape by waste heaps and, in the case of open-cast mining, the ruination of areas of countryside and the displacement of local people. Except in one or two isolated cases, this is no longer a problem. Although most of the major new mining developments in recent years have occurred in areas of low population density, virtually all governments now require full rehabilitation of mine sites, which begins even before mining is completed.

Coal companies work closely with governments and with local communities to ensure minimal impact on the environment to avoid not only the visual effects but also the emission of dust or fumes.

Transportation: Coal transportation by rail or by road, is now managed in such a way as to eliminate spillage of dust. The same applies to the loading and discharge of coal vessels. Coal shipments on the open seas constitute no environmental hazard and are completely safe. If a coal ship were to sink, the environmental damage is minimal - unlike the enormous problems that result from oil tanker disasters and consequent pollution of the sea and shoreline.

There are also no recorded instances of serious explosions or fires caused by the handling or transportation of coal. Coal is thus a safe and clean material to produce and to transport.

Coal Utilization: Most of the environmental arguments against coal focus on its use. There is no doubt that the direct burning of coal by households was responsible for much of the grime on European and American cities, the infamous smog, and for various diseases and other health problems this caused. This use of coal is declining very fast in Europe and has virtually disappeared in most other regions. The emissions from power stations, cement works and other large industrial plants are now the principal environmental concern but much of this concern is now unjustified. Over the last 20 years, the emission of particulates in the form of black smoke has been almost entirely eliminated - the white plumes seen at the tops of power station chimneys and cooling towers are merely water vapor which disperses harmlessly and quickly.

The other, less visible, problems are emissions of sulphur dioxide (SO_2),and oxides of nitrogen (NO_x), which are believed to cause acid rain.

These emissions are now being reduced everywhere by the use of lower sulphur coals, flue gas desulphurisation (FGD) and the installation of low-NO_x burners, all of which can reduce SO_2 emissions by up to 90 percent and NO_x emissions by more than 50 percent. Selective catalytic treatment can reduce NO_x emissions by 80-90 percent. New power stations currently being built and commissioned utilize new clean coal technologies, such as various forms of fluidised bed combustion (FBC), or gasification systems like the Integrated Coal Gasification Combined Cycle (IGCC) which emit negligible amounts of NO_x and collect virtually all the sulphur in a useable solid form.

These and other advanced combustion technologies also increase the thermal efficiency of power stations, hence improving economic performance and emitting less CO_2 per unit of electricity sent out. This is important if CO_2 reduction becomes a priority due to fears of global warming in the future. In fact, the average efficiency of coal-fired plants has increased immeasurably in this century, from below 5 percent at the beginning of this century to 35 percent now. This figure is likely to exceed 45 percent within 10 - 15 years, which will result in 23 percent less carbon dioxide entering the atmosphere for each Kwh generated. Whether or not the global warming theory proves to be correct, these improvements will reduce the cost of generation and help to conserve fossil fuel reserves.

Conclusions

Due to the high growth rates forecast for primary energy demand, there is room in the world market for greater volumes of both gas and coal.

In the longer term, coal offers greater security of supply, both physically and commercially, at stable prices.

Fuel costs account for 60 percent of total generating costs at gas-fired plants, as against 40 percent at coal plants.

The longer the period of power station operation, the lower is the capital cost advantage of gas - historically and currently, the life of coal-fired plants is more than 30 years.

The world economy cannot grow without energy - without coal, the energy requirements of the developing countries cannot be met.

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Nuclear Energy Challenges in the Former Soviet Union

*By Robert E. Ebel**

It was cold that morning in early March when the Russian fighter pilot slipped into the cockpit of his aircraft. Training missions were few and far between. Fuel was scarce and most pilots had been unable to keep up their flying skills. He hadn't been in the air for some time now, and he wondered whether he had lost his touch.

His orders were simple. Test his marksmanship. Fire air-to-surface missiles at selected ground targets. The sky was clearing in this southwestern portion of Russia as he took off. Soon he was over the target range. His first firing passes went well. Then disaster struck. A fired missile went astray. He notified ground control and returned to base.

Only later did the pilot learn that his errant missile had struck a scant 4 kilometers from the NovoVoronezh nuclear power plant. There are three operating reactors at NovoVoronezh - two VVER 440 reactors and one VVER 1000. Two earlier VVER reactors had been shut down a number of years ago. Net generating capacity at NovoVoronezh is 1,720 megawatts, making it one of the larger nuclear power plants in Russia.

This is what I call my Tom Clancy scenario. It has the makings of a great story.

But there is a difference. While many of Tom Clancy's scenarios are fanciful, the scenario I have just described for you actually happened. It happened in March 1995, a missile did go astray and did strike within 4 kilometers of the NovoVoronezh nuclear facility. Authorities later calculated that had the angle of fire been changed just 2 degrees, the missile would have struck the plant dead center.

When a military spokesman was questioned later by the press as to why a target range would be laid out so close to a nuclear facility, he just shrugged his shoulders. "We were here first," was his reply. "The nuclear plant was built later."

There is a financial crisis in Russia today, especially in the energy industry. Huge debts are piling up simply because there is no enforcement mechanism to ensure payment. The household user does not pay his electrical bill, knowing full well that he will not be cut off. That means the seller of electricity cannot pay for the coal, fuel oil or natural gas he has been burning. And that means the producer of coal, oil and natural gas has no money to pay his workers, to carry out equipment repairs and maintenance, and certainly no capital for new construction.

The Russian nuclear power sector has been suffering along with everyone else. Less than two-thirds of the power generated was being paid for. Cash payments covered little; most payments were in the form of barter. Salaries had not been paid for several months.

Not long ago a particular military establishment had been delinquent in paying its electricity bill. Arrears were getting higher and higher, and the local power station was becoming increasingly frustrated. What to do? The plant decided on its own to cut the power to this military facility. Now, this was no ordinary facility; it was something quite special. It was a naval depot, a home for nuclear subs. A decision to cut the power off nearly caused a propulsion reactor meltdown.

One last note of concern. There is a floating nuclear waste container, the ship Lepse, which is anchored within the city limits of Murmansk, on the Barents Sea. Lepse holds nuclear waste from Russia's three atomic-powered ice breakers and nuclear waste from the Northern Fleet's atomic-powered submarines. The on-board nuclear waste has a total radioactivity of 700,000 curies and, in the judgment of environmentalists, poses a potential threat three times that of Chernobyl. Western experts are now studying how to extract nuclear waste-filled containers from the Lepse so that the waste could be processed or at least stored elsewhere.

I relate this anecdotal evidence to you as a way of underscoring that the next nuclear accident in Russia or in the former Soviet Union, if there is one, may not be related to design errors or operator mistakes at a nuclear power plant, as it was at Chernobyl.

We need recall that Chernobyl was not the first nuclear-related disaster in the former Soviet Union. The first came in September 1957 when a nuclear waste facility at Kyshtym, a secret site near Chelyabinsk, exploded, contaminating a huge area. Ten years later, another disaster struck, again associated with nuclear waste.

For a number of years nuclear waste had been dumped into Lake Karachay, also in the Chelyabinsk region. The waste originated at Mayak, a secret city where nuclear weapons were being made. The lake evaporated during the long hot summer of 1967. Winds picked up radioactive dust from the dry lake bed and contaminated land and people as far as 50 miles away.

Both the Kyshtym and Mayak tragedies were kept secret for years afterwards.

The country is full of opportunities for a nuclear disaster but the West continues with its obsession that the two Chernobyl reactors must be shut down. A Memorandum of Understanding was signed last December between the government of Ukraine on the one hand and the G-7 and European Union on the other. This Memorandum focuses on the closure of Chernobyl by the year 2000, if adequate financing is forthcoming.

Let's presume that financing will become available and that the two Chernobyl reactors are shut down. Are our worries over? Of course not. There will still be 13 more Chernobyl-type reactors to go: 11 in Russia and 2 in Lithuania. Are we prepared to fork over billions to secure their closure as well? The Memorandum securing the closure of Chernobyl provides for grants and loan financing totaling in excess of $3 billion. Simple arithmetic tells us that following the Chernobyl precedence for all remaining similar reactors would cost the West $30 billion. Doable, of course, but I doubt that the political will is there and without the political will, nothing will happen.

General Concern For Nuclear Safety

Near the close of the June 1995 summit of G-7 member-countries, Russian President Boris Yeltsin proposed that they meet early in 1996 to address a number of issues relating to nuclear safety. The G-7 approved his proposal and met in a

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Nuclear Energy Challenges *(continued from page 25)*

mini-summit in Moscow on April 19-20, 1996. This mini-summit, in my judgment, had quite modest goals in mind, and these goals were basically met.

There were no surprises. The G-7 reaffirmed its commitment to provide $3 billion in loans and grants to support the closing of Chernobyl by the year 2000.

Perhaps the best that can be said is that nuclear safety concerns were raised to international level, where they belong. In the past, these concerns have largely been discussed on a bilateral basis.

1995 Russia

The Russian nuclear power industry ended the year 1995 with a smile on its face. Russian nuclear power plants generated a total of 99.3 billion kilowatt-hours that year, for a modest gain of just 1.5 percent. Why the smile then? Because all other forms of energy - coal, crude oil, and natural gas - continued their production declines. To give you a sampling of what has been happening in Russia's energy sector, consider this. The production of crude oil has fallen from 11.4 million b/d in 1988 to just 6.14 million b/d in 1995. This loss of more than 5 million b/d is unprecedented in world history. Throw in comparable losses in coal and declines in natural gas extraction, and the stability of nuclear power becomes even more welcome.

Nationally, nuclear electric power supplied about 11.5 percent of electricity generated in 1995, or half the relative share of nuclear energy in the U.S. But that is not the story. Virtually all the nuclear power stations are located in European Russia, that is, the area west of the Ural Mountains. Here domestic fuel production is limited. Thus, nuclear's role is local and regional, not national.

Ukraine

Ukrainian nuclear power also ended 1995 on an upbeat note. A new reactor had been completed and brought on-line at Zaporozhe, making this facility at 6,000 megawatts the largest in the former Soviet Union and in Europe. Last year nuclear plants generated 70.5 billion kwh or about 37 percent of the national total.

Earlier I mentioned a Memorandum of Understanding which hopefully will lead to the closure of Chernobyl by the year 2000. Unfortunately, anyone who examines this Memorandum closely will be struck by its vagueness. There is far less here than meets the eye. But its vagueness spells trouble ahead if the grants and loan financing are not forthcoming. Ukraine has already let it be known that the financing arrangements spelled out in this Memorandum - some $500 million in grants and $1.8 billion in projected investments by international lending institutions - are wholly inadequate for the tasks at hand.

To offset the loss of generating capacity at Chernobyl, an unfinished reactor at Khmelnitskiy and another at Rovno are to be completed.

Ukraine has been playing political hardball with Chernobyl and will continue to do so. After all, Ukraine has few points of leverage left to it, and it can be expected to take the fullest advantage of the Western desire to have Chernobyl shut down.

Armenia

Armenia too can look back on 1995 with a sense of satisfaction. Reactor no. 2 at the Medsamor nuclear power plant, which had been shut down since 1989, was put back in operation, with the substantial help of Russia. Armenia essentially has been shut off from outside sources of oil and gas because of a blockade imposed by Azerbaijan. Electricity availability was down to 1 to 2 hours a day. A decision to restart Medsamor was not all that difficult to make, despite opposition from the U.S. and others.

Lithuania

That leaves Lithuania as the only other republic of the former Soviet Union with a nuclear power industry. There is no country in the world more dependent upon nuclear power than Lithuania. Today in Lithuania, close to 90 percent of power generation comes from the Ignalina nuclear power plant, with its two 1,500 Mw RBMK reactors. Trying to convince Lithuania to close down Ignalina under these circumstances would be useless. Scandinavia instead has been working to support safety upgrades, the only acceptable approach.

Indeed, there is growing opinion in the West that the past policy of seeking reactor closure before financial aid would be provided was patently wrong and counter-productive. Pursuing this policy kept safety upgrading at undesirably low levels. A more enlightened approach now seems to have taken over.

There was some excitement surrounding Ignalina last year. On two separate occasions threats were made against this nuclear facility. Nothing came of these threats, but downwind Sweden has stepped in to strengthen security procedures in and around the plant.

Looking Into the Crystal Ball

I do not anticipate any dramatic change on the horizon for nuclear power in the former Soviet Union or in Eastern Europe. Nor can I think of any scenario that might suggest approval of an expansion program which would take nuclear power generation well beyond today's level. Given this comparatively modest role, nuclear power is unlikely to exert much influence on the production and export of other fuels.

There will be new reactor construction, of course, but the net gain in generating capacity should be relatively small. We should anticipate a comparatively sizable reactor construction program in the Soviet Far East. This area lacks its own fuel base and is at the end of an obsolete, overworked, and unreliable fuels and energy delivery system. Local nuclear power would improve matters considerably.

In the 1980s the former Soviet Union had the world's largest nuclear construction program in place. That program called for 200 gigawatts of generating capacity to be available by the year 2000. Then along came Chernobyl. The program was put in a deep freeze and there it has stayed.

Russia recently has developed an energy strategy to take the country to the year 2010. For nuclear electric power the goals are very modest: a minimum of 125 billion kwh by the year 2010; a maximum of 160 billion kwh.

The Russian Ministry of Nuclear Power is very ambitious, reflecting the personality of its leader, Viktor Mikhaylov. But he understands that if his Ministry is to remain solvent, let alone grow, it will have to seek business outside Russia and outside the former Soviet Union.

This search for new business is very apt to further confrontation between Russia and the U.S. The U.S. lost out in its efforts to keep Russia from contracting to complete the Bushehr nuclear power plant in Iran. The U.S. opposed the reopening of Medsamor, but lost out again. We should expect more confrontations in the coming years as Russia pursues reactor construction in Pakistan, India, China, North Korea and elsewhere; perhaps even in Cuba, where work stopped on the Juragua nuclear power plant in 1992.

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1997 Nominees Announced

At the Budapest Council meeting, Jean Masseron, Past President and Chairman of the Nominating Committee announced, on behalf of the Nominating Committee, the following 1997 officer slate:

For President-Elect	Charles Spierer
For VP of International Affairs	Guy Caruso
For VP of Finance	Edgardo Curcio
For Treasurer	Pieter Vander Meiren

Other members of the Nominating Committee were: Alberto Clo, Alioune Fall, Fereidun Fesharaki, John Ferriter, and Adrian Lajous.

President-Elect, Dennis O'Brien, will automatically move up to President in 1997. Ballots will be mailed shortly.

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Transportation demands a large and increasing share of total energy consumption in Europe. At the same time many European countries are facing difficult decisions in achieving their long term environmental goals. In particular the relative contribution from the transport sector and the energy sector involves a number of important and difficult issues. The conference will focus on economic and broader policy issues as well as technological perspectives. Further, focus will primarily be on medium to long term aspects.

The aim of the conference is to bring together economists, scientists, manufacturers, energy planners, transport planners and decisionmakers in order to discuss the importance of the transport sector in relation to energy demand and long term environmental goals.

General conference sessions cover:

- Trends in transport energy demand and environmental constraints.
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- Effectiveness of public policies, transport and energy sector.
- Method, models and data.

The conference will conclude with a panel discussion addressing the important issue of national vs. international aspects of transport, energy and environment.

The conference is organized jointly with the International Association for Energy Economics (IAEE) and the European Foundation for Cooperation in Energy Economics (EFCEE).

To obtain a copy of the preliminary conference program including registration form and for further information please contact:

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China, Oil and the Risk of Regional Conflict

*By Mamdouh G. Salameh**

As China approaches the twenty-first century, the future of its oil industry is causing it mounting trepidation. In 1993, China became a net crude oil importer for the first time.[1] In the face of declining oil reserves, flagging output and rising domestic consumption, China must make significant new oil discoveries if it is to maintain the momentum of its economic growth and avoid becoming heavily dependent on oil imports in the late 1990s and beyond. The Chinese are now struggling, not so much to increase, but just to maintain their current levels of oil production. They have been over-producing to meet their domestic needs at the risk of depleting their reserves and causing serious damage to their oil wells' reservoirs. The Chinese are not finding enough reserves to replenish what they have extracted, thus causing an annual deficit in their oil balance.

In its drive to find new oil reserves, China has been targeting two major oil provinces, the Tarim basin in the northwest of the country and the South China Sea, both of which are believed to contain potentially large oil reserves. Yet to achieve its objectives, China will have to surmount substantial financial and technical obstacles and, in the case of the South China Sea, added geopolitical and strategic problems complicated by territorial claims which could escalate into armed conflict between China and some of its Southeast Asian neighbors, especially Vietnam.

Of course, oil and geopolitics can continue to be a volatile mixture. After all, the first of the post-Cold War crises was the Gulf crisis, which was, in its essence, about oil and geopolitics.

The China Oil Factor

China's spectacular economic growth and its growing thirst for oil will impact most forcefully on the geopolitics of the Asia-Pacific region in the coming decade. And if China's economic growth continues at its current pace, it will become the world's third biggest crude oil importer after the United States and Japan. By the year 2000, China will need to import more than 2 million barrels per day (mbd) of crude oil if no substantial new oil resources are found. This could have a tremendous impact on global oil supplies and the price of oil. It could also have a significant impact on the strategic environment and the balance of power in Southeast Asia in view of China's search for oil reserves in the disputed territories surrounding the Spratly Archipelago in the South China Sea.

One thing, however, is certain. China will be as robust as the United States in defending its access to oil supplies. Furthermore, China may not shy away from the use of force to defend its rights of access. However, to satisfy its oil needs, China may look to the Middle East, Southeast Asia or Siberia. It could trade arms for oil with the Middle East or could use arms to secure oil supplies from Southeast Asia, especially from the South China Sea.[2]

China's Oil Fundamentals

China's proven oil reserves at the start of 1995 stood at 24 billion barrels (bb) with a reserve-to-production ratio of 22 years.[3] Estimates put China's proven and potential reserves at around 68 bb, of which 39 bb are onshore reserves and 29 bb offshore reserves. These estimates exclude potential reserves in the disputed territories surrounding the Spratly Islands in the South China Sea, estimated by some accounts to range from 7-130 bb.[4]

China became a net crude oil importer for the first time in 1993 and is projected to become increasingly dependent on oil imports between now and the year 2000. And to compound the problem, domestic oil consumption has been rising at an average annual rate of 8 percent between 1990 and 1994 while production has risen by an average rate of 1 percent during the same period (see Table 1).

Table 1
China's Crude Oil Production Vs. Consumption
1990-2000 (mbd)

	1990	1991	1992	1993	1994	1995	2000[1]	%Chg 90-00
Production	2.79	2.81	2.85	2.90	2.91	2.89	2.47	-11.5
Consumption	2.27	2.41	2.66	2.98	3.00	3.24	4.53	+100
Balance	0.52	0.40	0.19	-0.08	-0.09[2]	-0.35	-2.06	

[1] Forecast figures
[2] During 1994 China imposed quotas for crude oil and products imports.
Source: BP Statistical Review, 1995; China Energy Study, 1995, East-West Center, Honolulu,Hawaii, USA; Author's Projections.

In 1994, 80 percent of China's oil output originated from fields near the northeast coast, some of which have already peaked. The offshore sector produced 76,824 barrels a day (b/d) accounting for a mere 2.6 percent of total oil output (see Table 2).

Table 2
China Onshore and Offshore Oil Production Forecast
1990-2000 (mbd)

	1990	1991	1992	1993	1994	1995	2000
Total Production	2.79	2.81	2.85	2.90	2.91	2.89	2.47
Offshore Prod.	0.03	0.04	0.05	0.06	0.08	0.08	0.17
As % of Total	0.90	1.30	1.70	2.20	2.60	3.00	7.00

Source: BP; China Energy Study; Author's Projections.

Faced with declining oil reserves and rapidly growing domestic consumption, China is under increasing pressure to find new reserves. Without any new oil finds, oil imports are projected to rise over the remainder of this decade, reaching an estimated 2.06 mbd by 2000 (see Table 3).

Table 3
China's Crude Oil Exports and Imports
1985-2000 (mbd)

	1985	1990	1991	1992	1993	1994	1995	2000
Exports	0.60	0.53	0.40	0.19	-	-	-	-
Imports	-	-	-	-	0.20	0.09[1]	0.35	2.06

[1] Import quotas were introduced in 1994.
Source: BP; China Energy Study; OPEC Annual Statistical Review.

In its drive to find new oil reserves, China has been targeting the Tarim basin in the northwest corner of the

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[1] See footnotes at end of text.

country and the South China Sea.

The Tarim basin is the largest under-explored oil basin in the world. Here, trapped under the sands of this uncommonly harsh terrain, lie potential reserves estimated at 147 bb or more than six times China's current proven reserves.[5] That is one reason why Beijing finally allowed foreign oil companies to explore the basin.

In the offshore regions, the area with the greatest potential is the South China Sea.

China's Economic Success and Security Policy

China's influence will grow over the next decade or two as its economic power develops.

Estimates of the size of China's economy vary considerably. The International Monetary Fund (IMF) calculates that, on the basis of purchasing-power parity, China's Gross National Product (GNP) is slightly smaller than Japan's ($ 4,592 bn) and larger than those of France and the U.K. combined ($2,469 bn), thus giving it an estimated size of $2,469 bn to $4,592.[6]

Some analysts project that by 2005, China's economy will have overtaken Japan's to become the second largest economy in the world after the United States.[7] There is, however, a general consensus among experts that China can sustain growth rates of 7-10 percent per annum, implying a doubling of its GNP every 7-10 years.[8]

Whatever the precise calculations of China's future economic size relative to the U.S. and Japan, there is no doubt that China's economic power will affect the other Asian nations and will bring about a remarkable shift in the international balance of power. A positive link exists between China's economic success and its security policy. This has been demonstrated in recent years by China's enhanced capability for projecting power in and through the South China Sea in pursuit of its territorial and maritime claims.[9]

But economic success could also act as a constraint on Chinese security policy. Will an economically powerful China risk upsetting its neighbors in Southeast Asia over the South China Sea, when it is trying to attract investment and secure markets? The answer to that question will be determined by the power structure in the post-Deng China and also by China's need for foreign investment and technology. China's thirst for oil means that the development of the oil sector will be given top priority in investment plans. This will entail an estimated investment of more than $15 bn in the Tarim basin and the South China Sea. However, the size of this investment is so substantial that some observers doubt whether China could muster the necessary resources on its own.[10]

A Potential Asian Conflict Ahead?

Oil wealth beneath the South China Sea is fueling an explosive arms race in Southeast Asia. Every nation touching the waters between Japan and the Straits of Malacca has either announced or begun a major weapons build-up, fearing that a post-Cold War withdrawal of U.S. and Russian forces will bring long-suppressed territorial and maritime claims to a boil.

It is China's thirst for oil and its claims of sovereignty over the Spratly islands that is a major concern among the five other claimants of the islands, namely Taiwan, Vietnam, Malaysia, Brunei and the Philippines. The Spratlys are a valuable strategic prize, not only because they lie among major shipping lanes, but also because they lie atop substantial undersea oil and gas reserves.

In the past few years, Southeast Asian nations have watched with growing alarm as China has gone about developing a potent blue-water force with which to back its territorial claims. None of China's Southeast Asian neighbors can begin to match China as an emerging naval power. They are convinced, too, from all the evidence at hand, that the United States is withdrawing from the region as a geopolitical force and that, they fear, is creating a dangerous vacuum of power, one that China is only eager to fill.

At this stage, no one can say for sure whether China's current attempts to expand its influence reflect aggressive intentions or are simply the natural consequence of rising power.

Still, the threat of conflict is real. China threw down the gauntlet on 25 February 1992 when it passed a law asserting sovereignty over the Spratly, Paracel and Senkaku Islands and other specks in the South China Sea and warned it would defend them. But Japan told Beijing bluntly that the Senkaku Islands are Japanese indigenous territory. Since then, Malaysia, Vietnam and the Philippines have reinforced their troop strength in the Spratly archipelago.[11]

Consequently, this mix of overlapping territorial disputes, the continued build-up of military forces in close proximity to each other and the history of use of force by China in the recent past against Vietnam, could, in the absence of a settlement, give rise to the threat or use of force.

Conclusions

A settlement between China and the Southeast Asian claimants over the Spratly Islands could move the South China Sea disputes off the geopolitical stage and with them the opportunity for involving foreign outside powers. However, for a real settlement to be stable and equitable, it must be based on multilateral arrangements for the joint development of the potential oil and gas resources in the Spratly archipelago, which satisfy most of the central concerns of the claimant-states. Such arrangements must take into account the interests and the conflicting sovereignty claims as well as the need to acknowledge China's preeminent position as the leading regional power and also accommodate the interests of extra-regional maritime powers such as Japan and the United States.

If Beijing were to throw its weight behind such a solution, it could usher in an era of fruitful economic and prosperous co-operation between the nations of the region. However, despite all hopes of improvement, the most likely scenario for the future of the South China Sea is the status quo. But the status quo may be acceptable as long as relations among the claimants are good, or at least, not hostile. It could, through an unexpected political or military event, be transformed into open conflict.[12]

In the final analysis and in the absence of a real settlement, China will probably prevail either by its willingness to exercise force or the realization by the Southeast Asian nations that they cannot stand against China in the absence of a credible American counterweight. Either way,

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Deregulation of China's Oil and Gas Sector

*by Xiaojie Xu**

According to the China Academy of Social Sciences' Macroeconomic model, Chinese GDP will grow at a 9 percent rate from 1990 through 2000 and then level off at a 7.5 percent rate in the next decade. During the same period the China National Petroleum Corporation projects crude oil production to rise to about 4 million barrels a day (mbd) by 2010. Demand for oil, however, will continue to outstrip indigenous production, the gap between oil supply and demand being about 1 mbd in 2000 and about 2 mbd by 2010. This trend will greatly influence China's future policies.

China's oil and gas sector has undergone deregulation since the early 1980s. Unfortunately, this deregulation has been ineffective in revitalizing oil producers and promoting market-based competition. To comply with the country's escalating economic growth and competitive realities, a new oil/gas regulatory reform will be begun with petroleum legislation, new policy priorities, re-establishment of a Chinese independent regulatory authority and new industrial restructuring. These changes will bring new opportunities as well as new risks and threats.

Petroleum Law

China's current Law of Natural Mineral Resources seems ineffective in regulating onshore oil and gas activities where Chinese national oil companies are concerned. As a result, a study team headed by the China National Petroleum Corporation has been empowered to draft a new Chinese Petroleum Law. This first version of this will be submitted to the State Council later this year.

A Shift of Policy Priorities

To increase oil and gas supply and revitalize oil producers, a stable "supply quota contract" is proposed to replace the current increasing "production contract". This still requires oil producers to meet their supply commitment to the State, however, producers are free to otherwise rearrange their production so as to satisfy their long-term development plans. The gap between indigenous production and supply quotas can be filled from other domestic and international sources.

Gas policy has been linked with oil policy. This will continue for the short term. However, the regulation of gas transmission and distribution, including transnational distribution, will be governed by separate policies.

In the next few years, the current dual planned oil prices will be replaced by a single, changeable price. This price will fluctuate with world prices.

In the reform of oil taxation, international prices, commercial standards and tariffs will be emphasized. Consequently, fair, market-based competition will be encouraged. Once upstream marketing and competition policies have been implemented, internal markets will be opened to foreign oil players.

Foreign Policy

Chinese foreign policy in this area is two fold. It encourages both the participation of foreign investors/operators and the involvement in the world market. To enhance domestic production, current onshore oil and gas exploration and production bidding activities will continue. Current policies emphasize new exploration in strategic areas, including the Tarim area, EOR projects, associated downstream cooperation as well as infrastructure construction. Legislation on joint ventures and cooperative relationships with foreign firms will be encouraged.

Due to a forecast shortage in oil/gas supply relative to demand by 2000, China is doing its best to increase related infrastructure. Current planning calls for about 2500 miles of transnational pipelines across China. This pipeline construction will cost more than US$10 billion.

These policy changes will greatly encourage Chinese oil producers to enter national and international markets and will also open the door for foreign investment in China. But to facilitate this new environment will require an independent regulatory authority.

An Independent Regulatory Authority

To develop and sustain a healthy oil market, it will be necessary to establish an independent Chinese Regulatory Authority. This Authority would oversee the implementation of industrial policy and ensure market-based competition. The Authority's regulatory practices will be developed to fit China's realities. Eventually it will operate as an independent regulatory agency.

Additional initiatives involve the reorganization of the current government structure and oil/gas industrial framework. To promote national and international competition, this industrial restructuring should focus on a reorganization of the current four national oil companies. The proposed restructuring will focus on the core businesses of the NOCs and encourage strategic alliances worldwide. Establishing a governance structure for the NOCs will be a key part of this restructuring.

At the end of these initiatives, competition in China's oil market will be greatly enhanced. It should be noted, however, that the aim of the deregulation is to establish a competitive market and not a perfect market. The changes made must be compatible with the country's gradualism. Threats to this new deregulation include unbridled competition, runaway demand and inflation or political intervention.

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16th North American Conference Proceedings

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Do Firms Underinvest in R&D? - The Case of R&D in Oil and Gas Recovery

*By Ernest M. Zampelli**

The application of new technologies has had a profound effect on oil and gas exploration and development over the past 15 years. Examples include horizontal drilling, 3-D seismic and advanced recovery techniques such as CO_2 injection.[1] These and other advances are believed to have contributed significantly to the improvements in finding rates, success rates, finding costs and lifting costs which have occurred over the past decade.

Technology is expected to play an even more important role in resource development in the future. Though the world is endowed with a considerable volume of undiscovered oil and gas resources, recovery of significant portions of this resource base is contingent on the rate of advancement in extractive technology and hence on the level of investment in R&D for oil and gas recovery by firms in the oil and gas industry.[2] This analysis attempts to identify the major determinants of R&D investment. The approach follows Schumpter (1950) who emphasized the importance of firm size and market structure as well as the more recent literature which stresses the role of a firm's financial structure, especially the impact of cash flow on investment behavior. Previous research on R&D expenditures by firms in the petroleum industry by Baltagi and Griffin (1989) considered the latter influence but surprisingly did not examine the influence of the former. Moreover, their analysis examined total R&D expenditures which are comprised of expenditures not only for oil and gas recovery, but for petroleum refining processes and applications, coal, other energy sources such as solar and geothermal, and nonenergy areas such as chemical production. Accordingly, their analysis has little to say specifically about the determinants of R&D expenditures on oil and gas recovery. The following analysis is an attempt to remedy this deficiency. An econometric model is developed in which a firm's R&D expenditures on oil and gas recovery per barrel of production are hypothesized to be a function of the firm's size, its level of proved reserves, the share of proved reserves accounted for by natural gas, cash flow relative to assets, the price of oil, the share of fixed capital invested in oil and gas production, unobserved firm specific effects and merger activity. Using Tobit estimation for censored data, the model is estimated for 18 firms over the period 1978 through 1993.

Determinants of R&D Expenditure Levels

The Schumpeterian hypothesis that larger firms will engage in more innovative activity requires that any model of R&D activity incorporate the potential impact of firm size. In this analysis firm size is measured by beginning of year total assets. Since the likely relationship is probably nonlinear, the model includes the natural logarithm of beginning of year total assets as the explanatory variable with an expected positive sign consistent with the Schumpeterian hypothesis.

It is also critical to remember that the private incentives to engage in R&D are profoundly affected by the problem of nonappropriability, i.e., the inability of the firm conducting the R&D to capture the total benefits of its investment. Spence (1984), for instance, found that a decrease in appropriability, i.e., an increase in spillovers to others from the R&D, reduces the incentives to invest in R&D. One implication for private sector R&D in oil and gas recovery is that firms with small levels of proved reserves may have little, if any, incentive to engage in R&D activity. Consequently, one would expect R&D spending per barrel of production to rise with increases in reserves.

R&D is an inherently risky form of investment with long lead times. Together with the problems of nonappropriability and possible capital market imperfections, this will likely lead firms to rely on internal capital markets for R&D financing. Hence one would expect to find that a firm's financial characteristics are important in determining the level of its R&D spending. Following some of the most recent literature on determinants of investment spending, the model includes cash flow from operations (per dollar of assets) as an explanatory variable. It is calculated basically as net income plus depletion, depreciation and amortization expenses plus deferred taxes. Cash flow is expected to positively affect the level of R&D investment.

The benefits of R&D that improves oil and gas recovery are a function of the expected market value of the incremental production. Conservatively assuming constant real prices in the future, this analysis proxies expected market value by the current real world oil price.

As suggested above, a firm's R&D spending per barrel of oil equivalent (BOE) reserves is apt to be a function of its total BOE reserves. This, however, ignores the differences between oil and gas in terms of the opportunities for and payoffs from R&D expenditures. For example, horizontal drilling, one of the more important advances of the last decade has almost been exclusively applied to oil. Chemical, miscible and thermal recovery techniques are generally recognized as the most promising methods for the enhanced recovery of oil. There are exceptions. Advanced fracturing techniques lie largely in the domain of natural gas. Three dimensional seismic technology is applicable to both oil and gas but is mainly used in offshore exploration and development. In other words, a firm's level of R&D spending is a function not only of its total reserves, but also the oil/gas composition and the geographical location of those reserves and hence proved reserve share variables are included to control for these influences.

To control for the varying degree of diversification of the firms in the sample in their oil and gas recovery intensities, the model also includes the share of the firm's total fixed capital stock (at the beginning of the year) which is invested in oil and gas production. A firm's level of investment in R&D is also a function of its specific corporate culture and other unobserved firm specific effects. These are controlled for by a set of 11 firm dummy variables for those companies that generally invest in R&D for oil and gas recovery. An overall constant term is included which represents the set of those seven firms in the sample that report virtually zero spending on R&D over the sample period.

(continued on page 32)

*Ernest M. Zampelli is Associate Professor, The Catholic University of America, Washington, DC. This paper was presented at the IAEE Session of the Allied Social Science Associations' San Francisco meeting, January 5 -7, 1996.

[1] See footnotes at end of text.

Do Firms Underinvest... *(continued from page 31)*

It is important to note that the model also attempts to incorporate the influence of the major mergers in the oil and gas industry during this time period. The mergers accounted for are: Chevron/Gulf, Texaco/Getty, Mobil/Superior and Occidental/Cities Service. For consistency, these firms were treated as single entities throughout the sample period, i.e., for those years prior to a merger the data for the firms involved were combined to form a single entity. Four of the firm specific dummy variables, therefore, are associated with these combined entities. To examine whether the behavior of these combined entities is altered after the formal merger takes place, the model includes merger dummy variables which are equal to 1 beginning in the year immediately after the merger takes place and 0, otherwise.

Finally the model includes a dummy variable to capture the potential impact from the federal R&D tax credit which existed for the 1981-86 period.

Algebraically, the model can be written as:

$$R\&D = \alpha_0 + \alpha_1 LNSIZE + \alpha_2 CF + \alpha_3 LNRES + \alpha_4 GASSHR + \alpha_5 OGKSHR + \alpha_6 LNPOIL + \alpha_7 CREDIT + \alpha_8 EUROPE + \alpha_9 CANADA + \alpha_{10} MEA + \alpha_{11} OFFSHR + \alpha_{12} OTHSHR + \sum_j b_j FD_i + \sum_j b_j MERGE_j + e$$

Where:

R&D = research and development expenditures per barrel of production (in BOE);
LNSIZE = natural logarithm of beginning of year total assets;
CF = cash flow from operations per dollar of total assets;
LNRES = natural logarithm of reserves (in BOE);
GASSHR = share of reserves accounted for by natural gas;
OGKSHR = share of total fixed assets invested in oil and gas production at the beginning of the period;
LNPOIL = natural logarithm of the world oil price in 1994 dollars;
CREDIT = 1 if year between 1981 and 1986, 0 otherwise;
EUROPE = share of reserves located in Europe;
CANADA = share of reserves located in Canada;
MEA = share of reserves located in the Middle East and Africa;
OFFSHR = share of reserves located in the U.S. offshore;
OTHSHR = share of reserves located in other areas, except for U.S. onshore;
FD_i = firm specific dummy variable, i = 1 to 11;
$MERGE_j$ = merger dummy variables, j = 1 to 4;
e = random error term.

The model is estimated using data from the United States Energy Information Administration Financial Reporting System over the time period 1978-93. Included in the sample are Amerada Hess, AMOCO, Ashland, ARCO, Burlington Resources, Coastal, Chevron, Conoco, Exxon, Fina, Kerr-McGee, Mobil, Occidental Petroleum, Phillips, Texaco, Unocal, Union Pacific and USX (Marathon).

Estimation and Results

A substantial fraction of the firms in the sample reported several or more years of zero expenditures on R&D for oil and gas recovery. The application of ordinary least squares under these circumstances will yield biased and inconsistent estimates (Green, 1990). Consistent estimates can be obtained through the use of the Tobit estimation technique. An additional econometric problem is one of cross-sectional heteroscedasticity. The equation is estimated using Tobit with a correction for multiplicative heteroscedasticity where the firm specific error variance is a function of the firm specific dummy variables.

The results are reported in Table 1. Consistent with recent evidence, the coefficient on CF is positive. However, it is statistically insignificant. Apparently, a firm's financial structure in terms of cash flow and interest obligations is a relatively unimportant factor in determining a firm's level of R&D spending on oil and gas recovery. The negative coefficient on GASSHR is consistent with the view that R&D expenditures for oil and gas recovery are motivated by oil recovery as opposed to both oil and gas recovery. The coefficient is, however, statistically insignificant.

Table 1
Determinants of R&D Expenditures on Oil and Gas Recovery Per Barrel of Oil Equivalent Production

Variable	Estimate	(t-value)
Constant	-1.92	(3.11)[1]
LNSIZE	0.05	(3.41)[1]
CF	0.002	(0.07)
LNRES	0.06	(2.29)[2]
GASSHR	-0.18	(1.39)
OGKSHR	-0.02	(0.61)
LNPOIL	0.035	(2.75)[1]
CREDIT	0.016	(2.22)[2]
EUROPE	0.26	(2.21)[2]
CANADA	-0.22	(1.93)[3]
MEA	0.033	(0.28)
OFFSHR	0.23	(1.65)[3]
OTHSHR	0.1	(1.26)
MERGE1	0.017	(1.22)
MERGE2	-0.013	(0.75)
MERGE3	-0.07	(2.05)[2]
MERGE4	0.095	(3.14)[1]
Number of Observations	228	
Log-Likelihood Statistic	369.6	

[1] Significant at one percent
[2] Significant at five percent
[3] Significant at ten percent

The results are also consistent with the view that R&D expenditures per barrel rise with increases in reserves because the returns to R&D are plagued by nonappropriability. Specifically, the positive and statistically significant coefficient on LNRES indicates that firms with larger reserves tend to be more R&D intensive than their smaller counterparts.

The results do not indicate a significant relationship between R&D spending and the share of total fixed assets devoted to oil and gas production. The estimated coefficient on OGKSHR is statistically insignificant.

The presence of the R&D tax credit over the period 1981-1986 appears to have had a positive and statistically signifi-

cant impact on R&D intensity. Additionally, the results show that the expected market value of production as proxied by LNPOIL has a positive and significant impact on R&D spending levels.

Generally, the coefficients on the firm dummy variables are statistically significant indicating that differences in unobserved firm specific characteristics are important in explaining the variation in R&D spending across the firms.

The results indicate that the location of a firm's reserves plays a major role in the firm's level of R&D spending. Specifically, the positive and significant coefficient on EUROPE indicates that firms with a large share of their reserves in Europe will have higher expenditure levels on R&D. Given the harsh operating environment of the North Sea (the principal location of activities in Europe), this result is not surprising. The positive and significant coefficient on OFFSHR is expected given that the U.S. offshore represents an area in which technological advances are a source of significant competitive advantage. The coefficient on CANADA is both negative and significant. This is not entirely unexpected given that Canada has the dubious distinction of having the highest finding costs and the lowest finding rates for the firms in this sample.[3] The estimated coefficients for the remaining geographical share variables are highly insignificant.

The results indicate that the impacts of the different mergers in the industry over the sample period were mixed. Two of the mergers had no statistically significant impact on R&D intensity. One had a negative and significant impact on investment in R&D which is a result consistent with Jensen's free cash flow hypothesis and with the more simple view that the reduction in R&D spending reflected the elimination of duplicative R&D efforts. It may also suggest economies of scale in R&D activity. The other had a positive and significant impact on R&D activity indicating a possible reduction in the problem of nonappropriability as a result of the merger.

Summary and Conclusions

Using a panel data set of 18 large petroleum companies over the 1978-93 time period, this study has examined the determinants of R&D expenditures for oil and gas recovery. The basic model hypothesized that R&D expenditures per barrel of production for each firm are a function of the firm's size, its level of reserves, the share of reserves accounted for by natural gas, cash flow relative to assets, the price of oil, the share of assets in oil and gas production, the geographical location of its reserves, the R&D tax credit, unobserved firm specific effects, and merger activity. The model was estimated using the Tobit estimation procedure for censored data with correction for heteroscedasticity.

The results are consistent with the view that as a result of the problem of nonappropriability, only firms with very large reserves have adequate incentives to engage in R&D. The analysis also indicates that incentives to engage in R&D are far from uniform. Specifically, firms that have a large share of their reserves in Europe and the offshore U.S. will tend to invest more in R&D, *ceteris paribus*. Likewise, firms with a large share of their reserves in Canada appear to invest less in R&D.

The impacts of merger activity were shown to be mixed. In two cases, the results indicted no statistically significant effects of mergers on R&D intensity. In one of the other two cases, the results show a negative association between the merger and R&D effort while in another they show a positive effect on R&D expenditures for oil and gas recovery.

Footnotes

[1] See Moss (1994) for a discussion of technological innovations in exploration and development.

[2] See Fisher (1994), Natural Petroleum Council (1992) and EIA (1990).

[3] According to Ellsworth and Forbes (1994) finding costs (finding rates) for the FRS companies are highest (lowest) in Canada. See also Energy Information Administration, *Performance Profiles of Major Energy Producers*, 1993, p 35.

References

References are available from the author on request.

China... *(continued from page 29)*

the South China Sea could well become a "Chinese lake" by the end of the century.

Footnotes

[1] BP *Statistical Review of World Energy*, London, June 1995, pp.5-8.

[2] Gerald Segal, "Tying China into the International System," *Survival*, vol.37, no. 2., Summer 1995, pp.62-63.

[3] BP *Statistical Review of World Energy*, p.2.

[4] Mark J. Valencia, "China and the South China Sea Disputes," Adelphi Paper. 298 (Oxford: Oxford University Press for the IISS, 1995), p.10.

[5] *Wall Street Journal*, 10 October 1994, p.7.

[6] *Beijing Review*, 1-7 May 1995, p.7.; also Nicholas R. Lardy, "China in the World Economy" (Washington DC: Institute for International Economics, 1994), pp. 14-25.

[7] *Financial Times* report on China, 2 June 1995, based on a study, "Asia-Pacific Profiles" the Australian National University, Canberra.

[8] Paul Dibb, "Towards a New Balance of Power in Asia," Adelphi Paper 295 (Oxford: Oxford University Press for the IISS, 1995), p-27.

[9] Michael Leifer, "Chinese Economic Reform and Security Policy: The South China Sea Connection," *Survival*, vol.37, no. 2., Summer 1995, p.44.

[10] *Wall Street Journal*, 10 October, 1994, p. 7.

[11] *Newsweek*, 20 March 1995, p-33.

[12] Valancia, "China and the South China Sea Disputes," pp. 54-57.

Summer 1996 Publictions List

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Nuclear Energy Challenges *(continued from page 27)*

Russia and Cuba have been throwing out tantalizing tidbits to the media about completing Juragua. Cuba, of course, would benefit tremendously from the availability of nuclear electric power. Russia would also benefit, by being able to cut its deliveries of oil to that country.

Calendar

26-27 August 1996, LDC & Pipeline Ratemaking: Creating a Rate Structure That Allows You To Purchase. St. Louis, Missouri. Contact: Institute of Gas Technology, 1700 S. Mount Prospect Rd., Des Plaines, IL 60018-1804. Phone: 847-768-0783. Fax: 847-768-0842.

26-28 August 1996, Antitrust in Energy Markets. University of Wisconsin-Madison. Contact: Dr. Dennis Ray, Wisconsin Public Utility Institute, University of Wisconsin-Madison School of Business. Phone: 608-263-4180. Fax: 608-265-2737. E-mail: wpui@bus.wisc.edu

27 August 1996, Energy Industry Dialogue with APEC Ministers. Hotel Inter-Continental, Sydney, Australia. Contact: Stephen Burns, U.S. National Committee for Pacific Economic Cooperation (US-PECC), 1112 16th Street, NW, Ste. 520, Washington, DC 20035. Phone: 202-293-3995. Fax: 202-293-1402. E-mail: uspecc@erols.com

2-5 September 1996, National Energy Conference - CNE'96 "Improving Energy Efficiency in a Transition Economy." Neptun, Romania. Contact: CNE '96 Secretariat, c/o ICEMENERG, 8 Energeticienilor Blvd., 79619 Bucharest 3, Romania. Phone: 401-321-44-65. Fax: 401-321-10-10.

3-6 September 1996, Asia Pacific Petroleum & Energy Investment Exchange. Singapore. Contact: Shirlene Noordin, Conference Manager, AIC Conferences, Pte. Ltd., 12 Prince Edward Rd., #03-01, Bestway Bldg., Podium A, Singapore 079212. Phone: 65-222-8550. Fax: 65-226-3264.

11 September 1996, Climate Change Policy, Risk Prioritization, and U.S. Economic Growth. National Press Club, Washington, DC, USA. Contact: American Council for Capital Formation Center for Policy Research, 1750 K Street, NW, Ste. 400, Washington, DC 20006-2300. Phone: 202-293-6811. Fax: 202-785-8165. E-mail: mthorning@aol.com

12-13 September 1996, Introduction to Electric Power Systems for Legal and Regulatory Professionals. University of Texas at Austin. Contact: Dr. Ross Baldick, College of Engineering, University of Texas at Austin, ECJ 10.324/mail code C2101, Austin, TX 78712-1080. Phone: 512-471-5879. E-mail: baldick@ece.utexas.edu

23-25 September 1996, Energy Transitions in Mexico, Central and South America. Technological Museum of the Comision Federal de Electricidad, Chapultepec Park, Mexico City, Mexico. Contact: Dr. Mariano Bauer, Programa Universitario de Energia-UNAM, AP 70-172, 04510 Mexico, DF, Mexico. Phone: 525-622-8236. Fax: 525-622-8532.

1-4 October 1996, 1996 Gasification Technologies Conference. San Francisco, California. Contact: James M. Childress, Executive Director, Gasification Technologies Council. Phone: 703-276-0110. Fax: 703-276-7662. E-Mail: jmchil@aol.com

(continued on page 36)

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CONFERENCE ANNOUNCEMENT AND PRE-REGISTRATION

Calendar *(continued from page 34)*

3-4 October 1996, Transport, Energy and Environment. Elsinore, Denmark. Contact: Hans Larsen, Head of Systems Analysis Department, Building 110, Riso National Laboratory, P.O. Box 49, DK-4000 Roskilde, Denmark. Phone: 45-46-77-5101. Fax: 45-46-75-7101. E-mail: hans.larsen@risoe.dk

23-25 October 1996, Managing Costs in Downstream Oil Operations. Singapore. Contact: Shirlene Noordin, Conference Manager, AIC Conferences, Pte. Ltd., 12 Prince Edward Rd., #03-01, Bestway Bldg., Podium A, Singapore 079212. Phone: 65-222-8550. Fax: 65-226-3264.

28-30 October 1996, 17th Annual North American Conference of the USAEE/IAEE - "(De)Regulation of Energy: Intersecting Business, Economics and Policy." Boston, Massachusetts, USA. Contact: USAEE/IAEE Headquarters, 28790 Chagrin Blvd., Ste. 210, Cleveland, OH 44122. Phone: 216-464-2785. Fax: 216-464-2768. E-Mail: IAEE@IAEE.org

29 October - 2 November 1996, Energy and Power 1996 - EP China '96. China International Exhibition Centre, Beijing, P.R. China. Contact: Mr. Perry Tang, Adsale Exhibition Services Ltd., 14/F, Devon House, Taikoo Place, 979 King's Road, Quarry Bay, Hong Kong. Phone: 852-25163346. Fax: 852-25165024.

November 1996, International Gas Conference. Kish Free Zone Island. Contact: Dr. H. Zaheri, Fax: 9821-2220149, Tehran, Iran.

26-30 November 1996, 2nd Conference: Dam Safety Evaluation. Trivandrum, India. Contact: C.V.J. Varma, Member Secretary, Central Board of Irrigation & Power, Malcha Marg, Chanakyapuri, New Delhi-110021, India. Phone: 91-11-3015984/3016567. Fax: 91-11-3016347.

28-29 November 1996, Future Integration of the Baltic Sea States Gas Supply. Tallinn, Estonia. Contact: Mrs. Virve Kurnitski, Estonian Academy of Sciences, Kohtu 6, Tallinn EE001, Estonia. Phone: 372-2-451925. Fax: 372-2-451829. E-mail: riho@tan.ee

4-6 December 1996, POWER-GEN '96 International. Orlando, Florida, USA. Contact: Laura Ariane, Conference Manager, PennWell, 3050 Post Oak Blvd., Ste. 205, Houston, TX 77056. Phone: 713-963-6236. Fax: 713-963-6284. E-mail: lauraa@pennwell.com

11 December 1996, SNS Energy Day 1996 "Is There a Large-scale Future for Biomass Energy in Industrialized Countries?" Stockholm Sweden. Contact: Susanne Rothschild-Lundin. Phone: 46-8-453-99-77. Fax: 46-8-24-22-44.

22-24 January 1997, 20th IAEE International Conference. New Delhi, India. Contact: IAEE Headquarters, 28790 Chagrin Blvd., Ste. 210, Cleveland, OH 44122. Phone: 216-464-5365. Fax: 216-464-2737. E-Mail: IAEE@IAEE.org

16-17 February 1997, International Gas Conference. Kish Free Zone Island, Tehran, Iran. Contact: Dr. Hamid Zaheri, Iranian Association for Energy Economics, No. 125 Zafar Ave., Tehran, Iran. Phone: 98-21-225-7633. Fax: 98-21-222-0149.

2-4 July 1997, Third European Conference on the Integration of Central/Eastern Europe and Baltic Countries in the European Energy Market, Vienna, Austria. Contact: Pieter Vander Meiren, Phone/Fax: 32-15-20-48-57.

7-10 September 1997, USAEE/IAEE 18th North American Conference. San Francisco, California, USA. Contact: USAEE/IAEE Headquarters, 28790 Chagrin Blvd., Ste. 210, Cleveland, OH 44122. Phone: 216-464-2785. Fax: 216-464-2768. E-Mail: IAEE@IAEE.org

11-15 November 1997, Fifth Chemical Congress of North America. Cancun, Quintana Roo, Mexico. Contact: 5NACC Congress Secretariat, c/o American Chemical Society, Room 420, 1155-16th St., NW, Washington, DC 20036. Phone: 202-872-4396. Fax: 202-872-6128.

13-16 May 1998, 21st IAEE International Conference. Quebec City, Canada. Contact: IAEE Headquarters, 28790 Chagrin Blvd., Ste. 210, Cleveland, OH 44122. Phone: 216-464-5365. Fax: 216-464-2737. E-Mail: IAEE@IAEE.org

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