IA INTERNATIONAL ASSOCIATION FOR ENERGY ECONOMICS
EE

Newsletter

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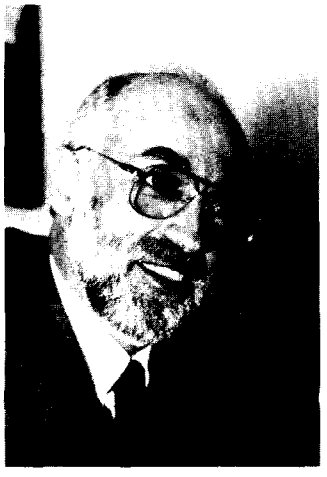
Fourth Quarter 1998

President's Message



As this will be my last message to you, I'd first like to thank the Association for affording me the opportunity to serve as president. I have found it a rewarding and stimulating experience. The enthusiasm and dedication I have found within our organization is truly heart warming and bodes well for our future.

Conferences

I've had the opportunity to attend three of our major conferences this year: the Quebec International meeting, which I commented on in my message to you in the last issue, and since then, the GEE/IAEE European Seminar on *Energy Markets, What's New?* in Berlin in early September and the annual North American Conference in Albuquerque, New Mexico, on *Technology's Critical Role in Energy and Environmental Markets* in late October.

Both these meetings were well attended and offered both high quality material and a good opportunity to network with others. My congratulations to Georg Erdman and his team on organizing the Berlin meeting and to Len Coburn, Arnie Baker and Michelle Foss and their team on organizing the North American meeting. Incidentally the proceedings of these meetings are available from the organizers and I commend them to you.

Council Matters

I last reported to you on the Council meeting held in conjunction with the Quebec conference and here I'd like to report briefly on the Council meeting held in Berlin in conjunction with that conference. A number of important issues were covered.

First, with the combination of the current VP for Finance with the Treasurer's job, Council was left with one less person. Council, therefore, has amended the bylaws to expand the number of appointed Council members to four (from three), but specifying that the General Conference Chair and Program Chair of the International meeting to be held in the following year be two of those appointed. In other words, Hoesung Lee will be appointing four Council members, two of which will be the conference chairs of the International Meeting to be held in the year 2000. This will give these persons an opportunity to interact with Council during 1999 in preparation for the 2000 meeting.

Second, Council approved five $2000 scholarships for deserving students in the field of energy economics in 1999. Elsewhere in this issue you will find an ad which describes this more fully and sets out application procedures. This seems a most appropriate use of some of the Association's funds. Peter Davies is heading this program with the help of Jean-Philippe Cueille and Michele Foss.

Next, Council, being concerned about the health of some of our Eastern European affiliates as well as anxious to expand the number of affiliates in this area, allocated $10,000 for this effort. Specific Council members have been assigned to work with individual affiliates so that our efforts can be carefully focused.

Council also approved the placing of the IAEE directory online. This will be done with sufficient security so that the integrity of the Association's membership roles will be maintained.

(continued on page 2)

Editor's Note

This issue of the *Newsletter* offers a close look at two energy industries: the European oil industry and the wind-energy industry.

Peter Davies and Paul Weston of the British Petroleum Economics Group in London exam developments in the European oil market since 1990 and then focus on future prospects, key policy issues and the uncertainties. They note that during the nineties, Western Europe has been evolving while the FSU has seen something of a revolution. With a little luck they believe the FSU could move forward in a more stable, evolutionary manner.

Mamdouh Salameh writes on the subject of Strategic Petroleum Reserves, noting that the United States has sold off some of its reserves, but, perhaps more important, rising oil demand has reduced the cover provided by that remaining.

(continued on page 2)

President's Message *(continued from page 1)*

One of the matters Council also discussed was the legal status of our affiliates. It is important that our affiliates be recognized legal entities in the countries in which they reside and thus be able to enter into contracts. Shortly, Headquarters will be contacting affiliates and asking them about their legal status and asking for copies of their bylaws.

Council also approved guidelines for the annual selection of winners of the Best Paper Award. This should help future VP's for Publications in the process.

Other items covered included the review and approval of a checklist of Association/Affiliate responsibilities to each other and guidelines for the appointment of Presidential Advisory Committees. A bylaw change regarding budgetary procedures was also put on first reading.

I'd like to wish Hoesung Lee all the best in his coming year as president and to thank the Council I have had the pleasure of working with for their support and help. Finally, a note of thanks to Dave Williams and his staff for their continued good work as our administrative arm.

It's been a good year and, again, I thank all of you for the opportunity afforded me and wish you the best for the coming New Year.

Charles Spierer

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

Meanwhile Saudi Arabia has somewhat quietly been building its own SPR and work is now close to completion. The mutuality of interests between the Saudis and the U.S. is evident.

While oil is old on the energy scene, wind-energy is not only fairly new (commercially) but also renewable.

Outside the United Sates, wind is the fastest growing energy source, with annual growth rates of about 40 percent per year in Europe. In the U.S. there are hints that a renewed interest in grid-connected wind power is emerging. Brian Parsons of the National Renewable Energy Laboratory looks at the factors that have impacted the wind-energy industry and are now, perhaps, beginning to revitalize it in the United States. He notes that up to now the European Union has taken the lead in bringing wind technology into mainstream power markets, however, thus far in 1998 wind development activity in the U.S. is greater than at any time since the heyday of the California wind rush of the early 1980s.

Future IAEE Events

June 9-12, 1999	22nd IAEE International Conference Rome, Italy *Hotel Parco dei Principi*
August 29-September 1, 1999	20th Annual USAEE/IAEE North American Conference Orlando, Florida, USA *Hilton at Walt Disney World*
June 7-10, 2000	23rd IAEE International Conference *Sydney Hilton* Sydney Australia
2001	24th IAEE International Conference Houston, Texas, USA

USAEE

IAEE

!! Visit our website at www.iaee.org for current program information !!

UNITED STATES ASSOCIATION FOR ENERGY ECONOMICS
INTERNATIONAL ASSOCIATION FOR ENERGY ECONOMICS

20th Annual North American Conference

THE STRUCTURE OF THE ENERGY INDUSTRY: THE ONLY CONSTANT IS CHANGE

Hilton at Walt Disney World - Orlando, Florida - USA
August 29 - September 1, 1999

Session Themes and Topics

Energy and the Global Economy: S.E. Asia, Russia, Latin America and OECD
New Financial Instruments for the Energy Industries
Incorporating New Technologies for the Energy Industry
North American Energy Integration
The Outlook for Oil Prices
Alternative Transportation: Implications for the Petroleum Industry
Developing Countries: The Status of Energy Development
A New OPEC?
The Climate Change Debate
Natural Gas Markets in the New Century
Electricity Restructuring: Lessons from Natural Gas
The Oil Industry: A Changing Market Structure
Energy vs. Envirnoment in the Gulf of Mexico

*** CALL FOR PAPERS ***

Deadline for Submission of Abstracts: April 21, 1999
(Please included your CV when submitting your abstract)

Anyone interested in organizing a session should propose topics, motivations, and possible speakers to:
Mary Lashley Barcella - 202-429-6670 / mlbarcella@msn.com
Mine K. Yucel - 214-922-5160 / mine.k.yucel@dal.frb.org

Abstracts should be between 200-1500 words and must clearly address the theme of the conference and topics above to be considered for presentation at the meeting. At least one author from an accepted paper must pay the registration fees and attend the conference to present the paper. All abstracts/proposed sessions and inquiries should be submitted to:

David Williams, Executive Director, USAEE/IAEE
28790 Chagrin Blvd., Suite 350, Cleveland, OH 44122 USA
Phone: 216-464-2785 / Fax: 216-464-2768 / E-mail: iaee@iaee.org

General Conference Chair: Michael C. Lynch
Program Co-Chairs: Mary Lashley Barcella & Mine K. Yucel
Arrangements Chair: David L. Williams

NEW THIS YEAR: USAEE Best Student Paper Award ($250.00 cash prize plus waiver of conference registration fees). If interested, please contact USAEE Headquarters for detailed application/guidelines.

We would very much like to welcome you at the 22nd IAEE International Conference on

NEW EQUILIBRIA IN THE ENERGY MARKETS: THE ROLE OF NEW REGIONS AND AREAS

Rome, 9-12 June 1999 – Grand Hotel Parco dei Principi

This three day Conference aims at discussing new relations and agreements between North Africa and the Middle East producing countries and industrialised regions in the framework of European co-operation. Some of the major conference themes and topics are as follows:

The role of Middle East for oil supplies to Europe and Asia; from the Caspian Sea to the Mediterranean: new routes for hydrocarbons; perspectives of energy markets in Central and Eastern Europe; deregulation and privatisation in Europe and Latin America; experiences of the regulatory processes of the gas and electricity sectors; natural gas from North Sea and North Africa to supply Europe; electricity markets in the Mediterranean Basin; the role of technologies and advanced systems to sustain world's energy development; the financing of energy projects; Post Kyoto follow up in industrialised and developing countries; long term scenarios for energy markets; energy companies strategies in the most competitive and global markets.

Rome will be the best meeting point to provide a unique forum where these and related issues will be debated by experts from around the world as well as the best starting point for delegates and accompanying persons to enjoy cultural visits and social events.

The *social programme* will in fact include a private guided tour visit to the Vatican Museums on Wednesday 9, a gala dinner in a fashionable Villa on Thursday 10, an exclusive concert in an ancient Roman Basilica on Friday 11 and a special fashion show for ladies on Saturday 12.

A variety of interesting *technical tours* will be offered to delegates to provide them with on site presentation to industrial plants located in some of Italy's most attractive regions, such as Lardarello (Tuscany) geothermal fumeroles and geothermal power stations; Ravenna (Adriatic Sea) offshore gas platforms; Portici (Naples) photovoltaic R & D center.

A variety of very pleasant tours and excursions will be offered at special rates for both delegates and accompanying persons during the days of the conference.

Conference registration fees are $550 for IAEE/AIEE members and $650 for non members; accompanying persons fees are $250. Conference registration fee includes attendance at all conference sessions, registration materials, refreshments, conference proceedings, 2 lunches, 5 coffee breaks, as well as the participation for both delegates and accompanying persons in the events organised within the social programme.

Special arrangements have been made with Grand Hotel Parco dei Pricipi (conference venue) as well as with other selected downtown hotels to offer special rates to the conference participants and their guests.

CALL FOR PAPERS

Deadline for Submission of Abstracts: 5 January 1999

Abstracts may be submitted for plenary as well as concurrent sessions. Anyone interested in organising a session should propose topics, objectives, possible speakers to the Programme Chairman well in advance of the deadline for submission of abstracts. At least one author from an accepted paper must pay the registration fee and attend the conference to present the paper. All abstracts, session proposals and related inquiries should be directed to:

Vittorio D'Ermo, Programme Chairman 22nd Annual International Conference of the IAEE
Telephone +3906 322 73 67; Fax +3906 323 4921 E-mail: aieeconference@mclink.it; vitder@iol.it

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For further information or preliminary registration, please fill and fax this form to the conference secretariat A.I.E.E. – Via Giorgio Vasari, 4 – 00196 Rome, Italy – Phone +3906 322.7367 Fax +3906 323.4921

22nd ANNUAL INTERNATIONAL CONFERENCE

INTERNATIONAL ASSOCIATION FOR ENERGY ECONOMICS

Grand Hotel Parco dei Principi, Rome – 9-12 June 1999

Family Name _____ First Name _____

Business Title: _____

Company/Organisation: _____

Address: _____ Town: _____

Zip/Postal Code: _____ Country: _____

Phone: ( ) _____ Fax: ( ) _____

E-mail: _____

Evolution and Revolution - Oil Markets in Europe and the FSU

*By Peter Davies and Paul Weston**

Introduction

In the early 1990s, Europe and the Former Soviet Union (FSU) held out the prospect of exciting developments for energy markets. The European Energy Charter promised to be the dawn of a new era, heralding co-operation, investment, and integration. It hasn't quite worked out that way, but the story is an interesting one nonetheless, and an important area for oil economists to understand.

The title of this paper, "Evolution and Revolution" - slow change and fast change - reflects, in our view, the regional oil market developments of the 1990s. And our thesis is that, looking forward, we will see a certain amount of role reversal. Western Europe has been evolving, but could see revolutionary change over the next decade. The FSU has been in revolution, but could, with luck, move forward into a more stable evolutionary paradigm.

The paper is organised in two sections. Section 1 concentrates on recent historical trends (1990-1997), while Section 2 focuses on future prospects, key policy issues and uncertainties. Analysis of Europe is, wherever possible, subdivided to cover the 'mature' economies of Western Europe separately from 'transitionary' Central Europe, which has had its own distinct characteristics.[1] Where helpful, an additional separation of South West from North West Europe is used to point up divergent trends. Unless otherwise referenced, all data is sourced from the BP Statistical Review of World Energy 1998.

Oil Market Developments Since 1990

Despite having less than 2% of the world's proved oil reserves, Europe's importance in world oil markets can hardly be underestimated. It accounted, in 1997, for over 20% of total consumption and almost 10% of total production. Furthermore, the North Sea[2] (which, since 1976, has accounted for the bulk of European production), has been critical, both in terms of driving the volume growth in non-OPEC production, and providing a technological lead - a proving ground for new, and often revolutionary, extraction and management techniques.

The FSU is no less an important player. It too has a relatively low share of world oil reserves (a little over 6%), while accounting for over 10% of total production. The region's share of world consumption, at 6% in 1997, was low by historic standards, but when at its peak in the early 1980s, the share was 15%. Although the region's star was much diminished in the early 1990s with economic collapse, the potential for consumption growth remains strong, as does that for production - centred predominantly on the Caspian.

The decade so far has been marked by a contrast of extremes. While consumption in Western Europe has been steadily evolving, production has been soaring with the North Sea at the cutting technological edge. Economic transition in Central Europe led first to a sharp decline in oil consumption, but new growth is beginning to emerge as reforms bear fruit. The FSU on the other hand, still looks to have some way to go before its own transition is complete. Having witnessed substantial decline in both consumption and production since 1990, there are signs that the corner has been turned - but only just.

Western Europe

With its predominantly mature economic structure, one might have expected the 1990s to be a period of relative calm for oil markets in Western Europe. Indeed, the consumption story turns out to be just that - slow evolution. But the story for production has been quite the reverse.

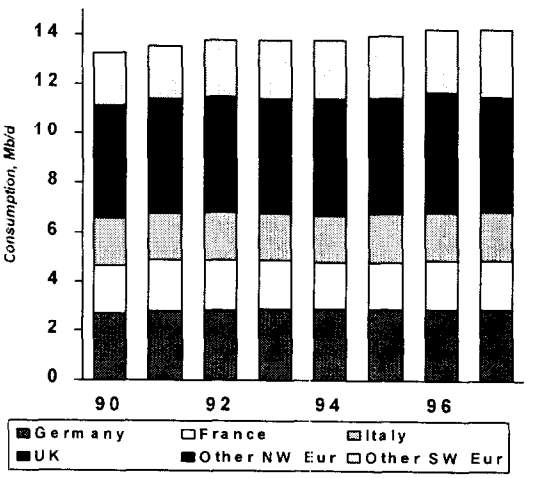
Consumption

Over the period 1990 - 1997, oil consumption in Western Europe rose by 7.3% from 13.3 to 14.2 million barrels a day (Mb/d). At just over 1%, the average annual growth rate was rather slower than the 1965-96 average (2.1%), but something of a turnaround from the average 0.7% per annum decline seen in the 1980s.

On a per capita basis, oil demand within Western Europe has been, if anything, on a gradually rising trend since 1990, although at 1.5 tonnes/person in 1996, it remains less than half the level found in the United States (3.1 tonnes/person). Oil intensity (the ratio of oil consumption to GDP) has fallen by nearly 4% since 1990 in the European Union (EU), from 109 tonnes/1990 M ECU in 1990 to 105 in 1997, implying greater aggregate efficiency in the use of oil.

The headline figures conceal though some striking national differences. The Republic of Ireland, buoyed by very strong economic growth, has seen oil consumption rise by over 5% a year on average, while the United Kingdom (UK), and more so Finland, saw oil use actually decline. Growth in South West Europe was on the whole faster than the North, some 2% per annum against 0.5%, with Spain, Greece and Turkey standing out as fast growing and relatively large markets.

Chart 1
Oil Consumption, Western Europe



Source: BP Statistical Review

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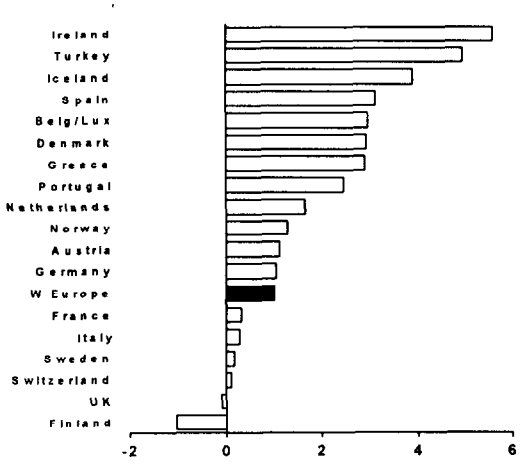
* Peter Davies is Chief Economist of British Petroleum Co. plc in London and Honorary Professor at the Centre for Energy, Petroleum and Mineral Law & Policy at the University of Dundee, Scotland. Paul Weston is an Economist in the British Petroleum Economics Group in London.

See footnotes at end of text.

Chart 2
Oil Consumption by country, percentage change per annum, 1990-97



Source: BP Statistical Review

Consumption growth in the major North West European economies has been slow for a combination of reasons:

- Economic growth, while higher than the 1980s, has been low relative to the Southern economies;
- There has been a marked shift towards consumption of natural gas in place of fuel oil in the powergen sector, and heating oil in the domestic sector;
- And finally, in the transportation sector, as a result of fiscal incentives, there has been a shift away from gasoline towards more efficient diesel. Ironically though, the pendulum appears now to be swinging back as a result of the same environmental concerns which provided the fiscal imperative in the first place.

The transportation sector merits further examination, not only because of its importance to overall oil demand, but because of the nature of the changes which have taken place in the 1990s. While the 1980s was clearly the decade of gasoline, the 1990s look to have marked a decisive move toward the middle of the barrel. Total European middle distillate consumption rose by 12% over the period 1990 - 1997, while gasoline demand rose by just 0.6%. The contrast with the last decade could hardly be starker, with gasoline consumption growing by over 11%, while middle distillate consumption struggled to rise by 0.8%. As a proportion of total European consumption, the middle distillate share grew to 41% between 1990 and 1997, while that for gasoline fell to below a quarter (24.4%) - its lowest level since 1987. In fact, 1990 looks to have marked gasoline's peak (at 25.5%), with market share falling steadily ever since.

The headline growth of middle distillates itself though conceals an important trend: the growth of diesel fuel's share of the middle distillate market. OPAL data reveal that, although demand for home heating oil (HHO) in the EU rose by almost 5% between 1990 and 1997, demand for diesel fuel grew by over 26%. From a near 50:50 split at the beginning of the decade, by 1997 the balance had shifted decisively toward diesel fuel, commanding 56% of the middle distillate market.

Chart 3
Diesel vs Gasoline demand in the European Union

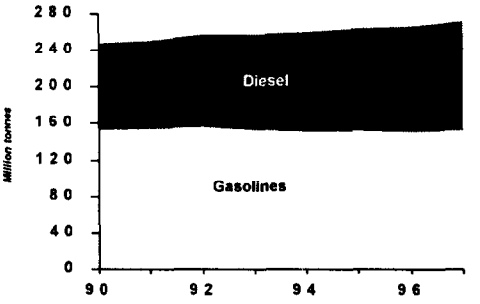
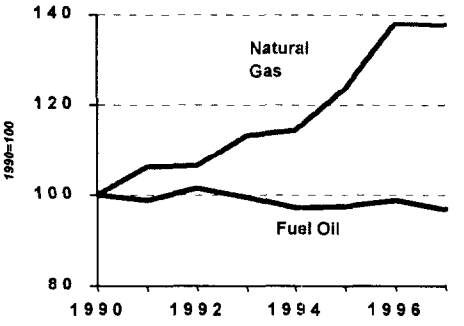


Chart 4
Natural Gas vs Fuel Oil demand in Western Europe



Source: BP Statistical Review

It is, of course, Western Europe which is driving the middle distillate growth. Demand in the region rose by over 15% between 1990 and 1997. Gasoline demand, in contrast, grew by just over 1%. What a recent study carried out for the European Commission by DRI[3] refers to as the "dieselisation of the car parc" is further limiting the potential for gasoline demand growth. They report that, since 1990, diesel cars have risen from around 15% of Western Europe's new car sales to 22% last year.

Production

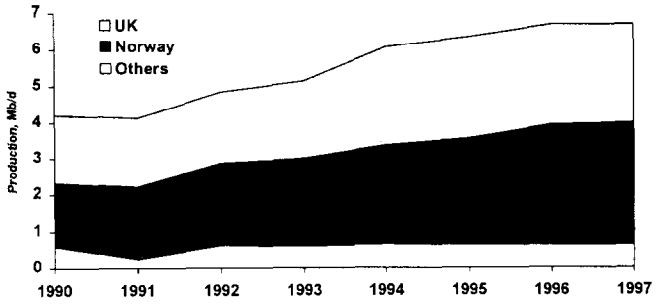
At the same time as Western Europe was seeing relatively slow demand growth, oil production has grown by more than 50% since 1990 to reach 6.7 Mb/d in 1997. While an increase of this magnitude would justify a paper all of its own, suffice it to say that there has been a 'revolution'. The North Sea has not fallen into decline as some had expected. Rather it has surged; driven by technology, cost cutting, and assisted by supportive fiscal regimes.

Western Europe's production is, of course, dominated by the two North Sea producing countries, UK and Norway, who accounted for over 90% of total production in 1997. And the degree of concentration has increased since 1990, when the combined UK/Norway share of total production was 80%. Norway took over from the UK as the largest individual West European producer in 1991, and has maintained its position with 50% of Western European production in 1997.

(continued on page 6)

Oil Markets in Europe and the FSU *(continued from page 5)*

Chart 5
Oil Production, Western Europe

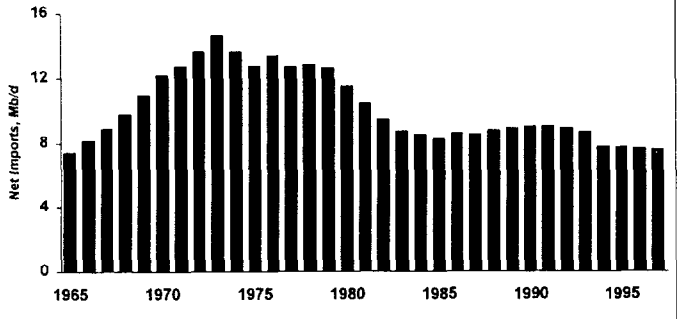


Source: BP Statistical Review

Trade

With 'revolutionary' increases in production, and slowly evolving consumption, the implications for trade are obvious. Western Europe's oil imports have fallen sharply, to their lowest levels since the 1960s, and North Sea crudes are now regular sources of supply for North American markets.

Chart 6
Net Oil Imports, Western Europe



Source: BP Statistical Review

At 7.6 Mb/d in 1997, Western Europe's net oil imports were at their lowest levels for over 30 years, and 1.5 Mb/d down on 1990. Trade flows over time are difficult to track because of data inconsistencies (unidentified sources and destinations), but in 1997, the major export flow from Western Europe was to North America, where the US took just under half of total crude exports and almost a third of total product exports; Canada took a further 39% of crude exports. Other major product customers included Central Europe and Africa, accounting for 25% and 21% respectively. Western Europe's main source of crude imports was, unsurprisingly, the Middle East, accounting for 47% of the total. North Africa (21%) and the FSU (17%) were also important suppliers. For product imports, the main source was the FSU - accounting for 33% of the total, followed by North Africa (21%) and the US (13%).

Western Europe's refined barrel is currently surplus light products, while its demand barrel is deficit in middle distillates. Surplus gasoline is largely traded into North America (which needs more gasoline than it can produce), while middle distillates are imported mainly from the FSU (which has a large surplus), and to a lesser extent, the Middle East.

Central Europe

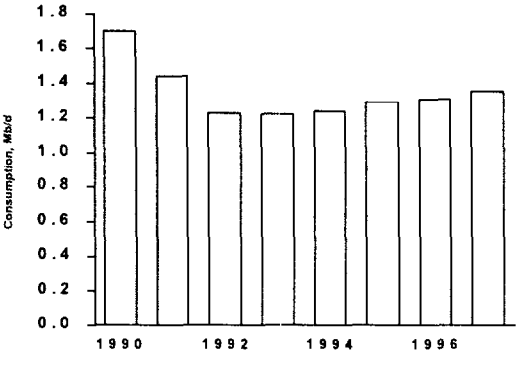
The story as far as Central Europe goes in the 1990s has been one of transition. At varying speeds, the economies of the region have adopted Western-style market reforms, and while this has led to an inevitable period of disruption, the seeds of reform are now beginning to bear fruit.

Consumption

With the partial exception of Poland (the region's largest consumer), the initial 1990s consumption picture was one of significant decline. Total oil consumption fell by more than 25% between 1990 and 1993, when the region's economic difficulties were at a peak. More recently, most of the economies have stabilised, and a selective recovery appears now to be underway, with aggregate oil demand rising in each of the last four years. Polish consumption has grown consistently since 1993; the pattern has been more volatile in the other economies within the region. The overall fall in demand between 1990 and 1997 remains over 20% though, from a level of almost 1.7 Mb/d to 1.3 Mb/d. Per capita, after averaging 0.71 tonnes/person during the 1980s, the rate fell to a low of 0.48 in 1992, but has since moved back above 0.5 (to 0.51 in 1996). Although much less efficient in terms of oil use than Western Europe (368 tonnes/1990 M ECU in 1995), significant strides are being made toward improving oil intensity.

In terms of product, Central Europe saw declines in consumption across the board, although fuel oil was particularly hard hit, registering a decline of over 37%. Middle distillate consumption fell by almost 20%, while gasoline demand held up somewhat, falling by just 4% over the period. As a consequence, its share of total product demand rose from 22% to 27%.

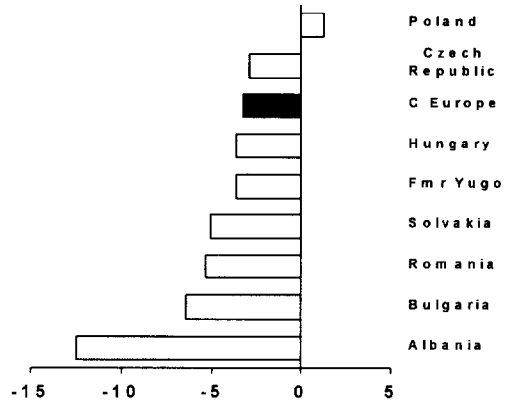
Chart 7
Oil Consumption, Central Europe



Source: BP Statistical Review

Recent strength has been concentrated in the transportation sector. Industrial demand has, on the whole, remained weak, although experience varies by country depending, for example, on the accessibility of natural gas, previous dependence on domestic lignite, etc. But having passed relatively quickly through a transition phase, the story looks likely to be progressive growth as the economies seek to catch up with their Western counterparts - and the tendency is greater the farther West one goes.

Chart 8
Oil Consumption by country, percentage change per annum, 1990-97



Source: BP Statistical Review

Production

Central European production is minute by comparison with its Western counterpart. At just 260 thousand barrels a day (Kb/d) in 1997, it was only 1/25th the level of production in Western Europe. Like the West though, that production is concentrated, over half accounted for by a single country - Romania. Regional production has been declining very gently since its peak in 1977 (492 Kb/d).

Trade

For Central Europe, the major source of imported crude in 1997, not surprisingly, was the FSU (accounting for almost 58% of the total). The main alternative source was the Middle East, accounting for just over 30%. For products, while the Middle East's share was 22%, most of the remainder came from Western Europe. The dominant export customer for Central Europe's refined products was Western Europe, taking almost 75%.

After the collapse of the Council for Mutual Economic Assistance (CMEA) trade arrangements in January 1991, Central European countries who had relied upon cheap Soviet energy imports, often down the Druzhba pipeline, were forced to pay 'market' prices and so began to explore the possibility of using other sources. While total imports were hit during the early part of the decade because of recession and economic restructuring, it is notable that imports from Russia/FSU suffered the most - accounting for just under 40% of crude imports in 1993 compared with nearly 65% in 1990 (and over 73% in 1985). For products the extent of the move away from the traditional supplier was even more marked: accounting for almost 80% of imports in 1990, by 1993 Russia/FSU supplied only 11%. Since 1993 though, Russia has made some effort to regain market share, and for crude at least, these efforts have borne fruit.

Former Soviet Union

In the FSU, the 1990s have witnessed momentous change in oil markets, just as we have seen radical upheaval in both the political and economic environment.

Consumption

Oil consumption in the FSU fell by more than 50% over the period from 8.4 to 4 Mb/d. While the heaviest decline occurred in 1993 (almost 20%), the fall in 1996 was still around 10%. Indeed, so large has been the decline that, when looking at the picture for total world demand in the period 1990 to 1993, one can easily be forgiven for thinking that world demand was basically flat. Exclude the drop in the FSU and you get a very different picture with world oil demand surging by around 2% a year.[4] 1997 may prove to be the turning point though, marking the first year since 1990 of consumption growth. While the rise was small in itself (just over 1%), it does appear to re-establish the trend recovery which looked to be under threat in 1996.

On a per capita basis, consumption more than halved from Western European levels (1.45 tonnes/person) in 1990 to less than 0.7 tonnes/person in 1996. After year on year reductions in oil intensity during the 1980s, the rate surged in 1992 (back, in fact, to 1981 levels) as the economy collapsed. With the manufacturing sector beginning to invest in more fuel-efficient machinery, the intensity measure has since fallen back sharply again - but at nearly 600 tonnes/1990 M ECU, it remains far in excess of European levels.

While as a share of total primary energy demand oil in Europe remained very stable over the period 1990 to 1997 (at 41-42%), in contrast the FSU has seen a significant erosion of oil's importance as an energy source. Oil's share of total primary energy demand fell from 30% in 1990 to 22% in 1997, its place largely being taken by gas which expanded from 43% to 50%.

Production

Having fallen by almost 40% between 1990 and 1996, FSU oil production at last looked to have turned around in 1997. 1997's rise of just under 0.2 Mb/d (2.6%), while small in itself, is significant in being the first increase since 1987 - when output peaked at 12.6 Mb/d. The collapse of the Soviet economy hit the oil production sector hard: new national boundaries cut upstream operators off from their equipment suppliers; state trading networks disappeared; management was in turmoil over privatisation; and companies simply lacked cash flow and capital to support production.[5] Foreign investment meanwhile proved to be small in total in light of legal uncertainties, lack of export licences and payments arrears.

The aggregate data though hide somewhat the divergent experiences of the individual republics. Output from Kazakhstan, for instance, turned up in 1995, and recorded a strong increase (over 12%) in 1997. Kazakhstan now accounts for 7% of total FSU production, against 5% in 1990. Output has been growing in Uzbekistan - which now accounts for 3% of total FSU production - since 1992, while growth is yet to re-emerge at all in Azerbaijan; 1997 output there was 0.6% down on 1996. Russia itself, now accounting for some 84% of total FSU production (down from 90% in 1990), saw growth of just under 2%.

Initial evidence for 1998, however, indicates that 1997 was something of a false dawn. In face of lower international oil prices, Russian production is reported to have fallen back again. Exports, however, seem to have been maintained and possibly even increased as a result of the desire to maintain access to 'hard cash'.

(continued on page 8)

Oil Markets in Europe and the FSU *(continued from page 7)*

Chart 9

FSU Consumption, year-on-year change

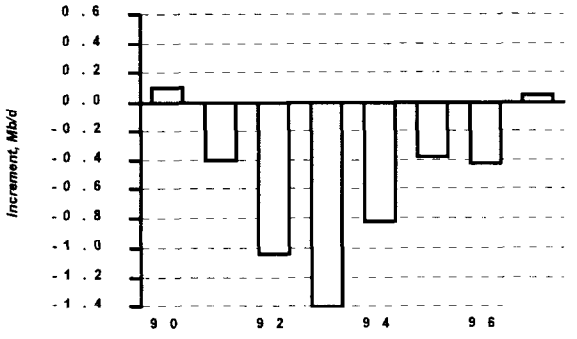


Chart 10

FSU Production, year-on-year change

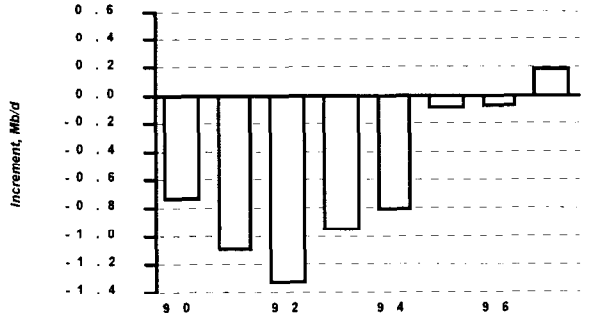
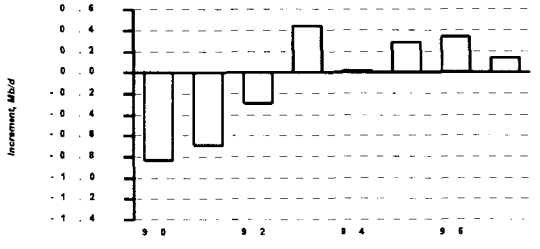


Chart 11

FSU Net Exports, year-on-year change



Source: BP Statistical Review

Trade Flows

In the 1980s, the level of FSU net exports averaged 3.9 Mb/d. While the early 1990s saw both oil production and consumption in decline, production was hardest hit, resulting in the net export position worsening significantly. In 1992, it had fallen to levels not seen since 1970 (2.2 Mb/d). The situation has since improved - back to 3.4 Mb/d in 1997. Exports of crude oil are predominantly to Western Europe and Central Europe, accounting for 88% of the total (60% and 28% respectively). Almost 44% of product exports are destined for Western Europe, but a substantial chunk of almost 35% of the total are unidentifiable.

One particularly interesting feature of the early 1990s was the change to intra-FSU trade flows. Before the break-up of the Soviet Union, as the dominant producer of crude oil, Russia was the major source of nearly all the region's foreign oil exports. It was also the supplier of oil to most of the other republics - at that stage as part of domestic trade at prices that were low in international terms.

In 1992, the Russian government, faced with a decline in production, and a continued need to earn hard currency abroad, sought to mitigate the problem by attempting to receive full payment for their oil in hard currency. As this proved impossible to achieve, deliveries to the former Soviet republics were reduced. While crude and product exports abroad rose by 7%, and domestic consumption fell by 14%, deliveries to the former Soviet republics fell by 29%. Economic problems in the former republics have undoubtedly played a part in depressing oil demand, but Russia's priorities were clear - to be paid; and to be paid in hard currency. Exports to the republics have since fallen further still - to around a quarter of their 1991 level in 1995.

Future Trends and Forces for Change

At first glance, it might appear self-evident that Central Europe and particularly the FSU are the regions where forces for future change will be most intense. Having fallen to rock-bottom, there is really only one way to go for these economies, and good progress, particularly in Central Europe is already beginning to show through (the FSU is another matter - deep political and financial problems are still in need of resolution). Economic development always has, and probably always will, imply a greater demand for energy. And while, as in Western Europe, some sectors will turn to gas as the primary source of that growth, oil will not be left behind. Increased transportation use (e.g., car ownership, miles driven, etc.) will be a key driver, and oil is, and will likely remain so for some considerable time yet, the dominant fuel in the transport sector.

We should not though lose sight of the forces for change in Western Europe. While the outlook for production is probably rather unexciting (with the possible exception of new techniques which are likely to continue to be pioneered in the North Sea in an effort to extend the life of reserves), and economic growth prospects suggest relatively slow growth of oil demand (other things equal), there are some key challenges ahead for European oil markets, including: the Kyoto protocol and its potentially dramatic effect on fossil fuel consumption; supply security and the prospects for regional oil market integration; and North Sea decline. We examine some of the issues below.

Western Europe

It is now becoming widely believed that, after evolving to major producer status in the 1990s, the North Sea is approaching its peak. While such predictions have been made on a number of occasions in the past, the evidence is now growing that peak production for the UK is in sight, especially following recent well-publicised reductions in exploration spending. In Norway, the issue is less the geology or the exploration economics, rather it is a policy led event driven by concerns over overheating within the domestic economy, and an intent to restrict production in line with OPEC attempts to limit the world's current overproduction of oil. Estimates suggest that decline will probably set in at some point between 2000 and 2005, with the UK peaking before Norway. However, production looks likely to tail off rather gradually as enhanced subsea technology allows greater recovery, and access to previously inaccessible areas. It will

also be a function of fiscal terms.

As a testament to the triumph of technology over depletion, it is worth mentioning that forecasts have for some years tended to push out the peak with each year's revision. The latest EIA[6] long-term forecast, for example, shows output peaking later, and at higher volumes (+1 Mb/d) than their last forecast made just a year ago.

But if it is widely accepted that production is set to mature, it is less widely acknowledged that Western Europe faces the prospect of revolutionary change on the demand side. Environmental considerations are becoming a major force for change in Europe - both in terms of clean air, and global warming. Mainstream forecasts already project Western Europe as the slowest growing region in the world over the next decade, and that is without the assumption of new demand restricting policies. (The EIA "reference case" forecast, for example, puts the average annual increase at just 0.3% between 1995 and 2020, to leave total demand up a meagre 1.3 Mb/d).

Table 1
EIA "Reference Case"Forecasts for Consumption and Production,
Western Europe

Mb/d	2000	2010	2020
Consumption	14.3	14.9	15.4
Production	8.2	7.5	6.3

In terms of product demand, the recent decline in the relative price advantage enjoyed by diesel over gasoline, along with growing concerns expressed over particulate pollution and clean air, is likely to trim future middle distillate demand growth. The share of diesel in new car sales appears to be stabilising, but DRI, for example, still expect growth of 2.7% per annum between 1996 and 2001, while gasoline grows at only 0.7%. Diesel is furthermore expected, this year, to replace gasoline as the fuel with the largest share of the European transport fuel market.

As and when North Sea production declines, Western Europe's net import requirements will clearly grow if demand continues to rise. The main source of future incremental supplies may be the FSU, and especially the Caspian - the EIA expect it to increase its share from 14% in 1995 to over 20% in 2020. Reliance on supplies from the Persian Gulf will increase, but probably only modestly (the EIA suggest a rise from 29% to 31%), an outcome rather at odds with widespread perceptions that Europe will come to depend more and more on potentially unstable Middle Eastern countries for its oil. While this is still potentially true of the long term, it really does appear to be a very distant prospect.

North Sea Issues

If declining production in the North Sea is probable, the *rate* of decline remains a key uncertainty as we look forward. A cloud on the horizon as far as UK production is concerned is the imminent governmental review of the North Sea taxation regime. Industry leaders have already voiced concerns that any increase in the burden of taxation risks making future developments in the North Sea unprofitable (and thereby perversely lowering the government's total tax take), particularly in the current low oil price climate.

Meanwhile Norwegian production policies are under review. The issue was at first the country's economic situation - Norway has what many countries would regard as an enviable problem; it is generating too much oil revenue. Indeed, the government has recently highlighted what it sees as the risks of economic overheating (not to mention sectoral imbalance) and has taken steps to reduce the pace of oil industry investment. Now though, with prices having collapsed, the issue has turned to state determined production cuts as part of wider industry restraint (for example, Norway's participation in the Riyadh Agreement). It is, for the moment, unclear how these short-term issues might affect production over the next decade, but genuine reductions in investment would be certain to have some longer-term ramifications

Security of Supply

While supply security is widely taken for granted these days by final consumers, it is still an issue which generates concern, particularly amongst politicians, to whom the dictum of 'keeping the lights on' remains a powerful influence. Supply security has remained a key tenet of European Union energy policy despite increasing availability. Energy markets as a whole have become far more open and market oriented, and the degree of consequent integration has led to a situation where it would be almost inconceivable for a single European country to be forced by the actions of another country to go without oil. Even for Europe as a whole, fears over supply security appear groundless. The world's major oil producers have progressively realised over the last two decades that their interests are best served by maintaining adequate supplies of oil at moderate prices. Physical disruption is no longer seen as a rational policy option. Meanwhile others such as Odell (1998)[7], for example, point to the progressive integration of Turkey which is seen as becoming central to the potential expansion of Middle East/European hydrocarbon trade.

The Impact of Kyoto

By far the biggest uncertainty facing Western Europe though is the environmental imperative. While ultimate ratification of the protocol agreed in Kyoto in December 1997 remains in the balance, its implications are sufficiently far-reaching to warrant serious consideration sooner rather than later. The target for the OECD as a whole is, by 2008-12, to reduce greenhouse gas emissions by 7% *below 1990 levels*. For the EU, the target is slightly higher at 8%, and there is a determination, at the highest political levels, to meet such targets. For economies which have seen oil demand grow by over 1% a year over the last decade, this kind of reduction would clearly imply a paradigm shift.

As many observers, most recently the Centre for Global Energy Studies (CGES)[8], have pointed out:

> *"It is all very well to talk of reductions in emissions from the 1990 levels but, by the time the targets must be met, the world will have moved on and the actual reduction required will have to take into account the twenty years of energy demand growth that would have taken place in the intervening years under a 'business-as-usual' scenario."*

The CGES go on to calculate that, if the Kyoto reductions are achieved through pro-rata cuts in the consumption of all three fossil fuels, and assuming oil would have continued to hold its ground as a share of total energy consumption without

(continued on page 10)

Kyoto, then OECD oil demand in 2010 would have to be some 5 Mb/d below the level prevailing in 1996, i.e., a reduction of more than 13% from *current* demand. While it is most unlikely that the burden of reduction will fall equally on oil, gas and coal (coal must be a favourite for sharper cuts given its relative polluting capacity), the CGES provide a further illustration of the potential magnitude of the change required by calculating the price increase necessary to induce such a dramatic shift in consumption behaviour. With a long-run price elasticity estimated at -0.7 for OECD oil demand, they point out that oil prices would have to rise by 41%, *in real terms*, to generate the required 29% demand reduction.

In other words, such targets are extremely challenging. If met, they would represent a major structural change to oil demand. Nevertheless, European governments have begun to assess policies to meet such targets. In the UK for example, the Marshall Committee on Economic Instruments and the Industrial Use of Energy has been established to consult and recommend measures to reduce industrial greenhouse gas emissions. It is specifically assessing emission trading schemes and an industrial energy tax. Other European governments are also assessing policy options.

Tied in to the Kyoto debate, is the question of future car use in European cities. There is a growing consensus that something must be done to limit access by motor vehicles to European city centres, because of the twin problems of pollution and congestion. The *Financial Times*[9] recently reported on a project initiated by Athens, Barcelona, Florence, Lisbon, Oxford and Stockholm (the Alternative Traffic in Towns - Alter - project) to give exclusive city centre entry rights to zero or low-emission vehicles over the next ten years. Governments have so far taken a fairly haphazard approach - implementing ad-hoc bans for example, but a more structured, integrated approach, probably involving some form of charging regime, or even outright prohibition, must be on the cards at some stage. The UK government has recently issued a White Paper[10] to consider options for a radical change in transport policy, none of which involve promoting the use of motor cars.

Central Europe/FSU

Having successfully emerged from their transition periods, the economies of Central Europe look set for a period of 'catch-up' growth in oil demand. Their potential has been recognised by forecasters, who expect oil demand growth in Central Europe to be stronger than any other region outside of the developing world over the next two decades. (The EIA's "reference case" forecast is for annual demand growth of 2.9% between 1995 and 2020, allowing consumption to precisely double. In an alternative higher economic growth scenario, the EIA suggest that demand growth could be as high as 4.2% a year). While the region will not be immune to the shifting pattern of energy usage (oil to gas) seen in recent years in the West, demand pull is likely to come particularly strongly from the transportation sector.

With little indigenous production, Central Europe's demand growth must be met by growing net imports. The trend away from energy supply ties with the FSU will probably continue as the region seeks to diversify it sources, importing more oil principally from Western Europe.

Table 2
EIA "Reference Case" Forecasts for Consumption and Production,
Central Europe and FSU

Mb/d	2000	2010	2020
Central Europe			
Consumption	1.5	1.9	2.6
Production	0.3	0.4	0.4
FSU			
Consumption	4.4	5.9	7.5
Production	7.5	12.1	13.2

The future for the FSU is much harder to call. Resource rich, and with a considerable amount of economic catching-up to do, prospects for both oil production and demand should be exciting indeed. But while the region is now almost certainly past its low point (just), the political, economic and financial situation remains sufficiently unsettled to make any forecasts highly uncertain. On balance, oil demand will grow - but only relatively slowly and by less than GDP. Natural gas will gain an increasing hold on the static energy sector, confining oil growth predominantly to transportation. Oil use in the industrial sector will almost certainly decline, given the potential for efficiency improvement and the expected decline in traditional heavy industrial output despite positive overall economic growth.

But if the consumption story is merely evolution, it is production which potentially offers the revolution. With estimates[11] of proven oil reserves in the Caspian region varying between 15 and 40 billion barrels, the FSU looks set to regain its status as the primary non-OPEC producer (now as a region rather than a nation), which it lost to the US in 1993. And much of the region remains unexplored or underexplored, so the likelihood of additional reserves being found is high. By 2010, it has been estimated that Caspian oil production could reach 3.9 Mb/d, with 2.3Mb/d available for export.

The potential for Russian oil production is also substantial - if domestic investment laws can be clarified. Despite considerable interest, both among Western and domestic investors, direct investment has been limited so far because of the risks and uncertainties involved. Nevertheless, we have begun to see Western companies make equity investments in Russian producers (for example, BP and Sidanco), and these are expected to bear fruit in the coming decade.

With prospective FSU oil production set to outstrip home consumption growth, the FSU is set to significantly increase its net exports. EIA estimates show net exports more than doubling between 1995 and 2020, to reach 5.6 Mb/d. The EIA projects FSU dependence on Western Europe as a customer diminishing somewhat though, to 43% by 2020, as China, Industrialised Asia, and even North America could become important customers, although this depends greatly upon the future availability of transportation infrastructure.

One of the key uncertainties when looking forward for the FSU is the issue of Caspian export routes. Although Caspian oil, in small quantities, is already able to flow through pipelines into and through Russia, future development will require additional routes, to the West and possibly even to the East. Commercial, economic and political realities point to an eventual set of multiple pipelines transiting different countries and supplying different markets.

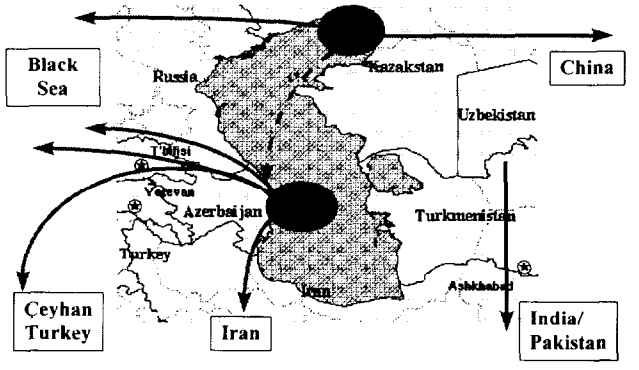
Four broad options suggest themselves, each with its own set of potential difficulties:

- Through the Bosporus. In this case oil goes initially to a Black Sea port in one of a number of ways (e.g., through Russia from Azerbaijan and Kazakhstan and through Georgia directly from Azerbaijan) and is then shipped to the Mediterranean[12] through the Bosporus. Transit of the Bosporus is a highly contentious political and environmental issue, and such an approach is likely to take oil to a market where there is already adequate supply;
- From Azerbaijan via Georgia to Turkey (Çeyhan). A longer and therefore more expensive pipeline route, again taking oil to an oversupplied market;
- Send it South. The most commercial export route, swapping into the refineries of Northern Iran in place of Iranian crude and taking Iranian crude from Khargh Island. A further expansion would be the construction of a dedicated export pipeline through Iran to the Persian Gulf coast for export to Asian markets;
- Send it East - to either China or India/Pakistan. The Chinese route directly from Kazakhstan would be very long. The India/Pakistan option would most likely require transit of Afghanistan, a route which will, in all probability, remain out of the question for the foreseeable future.

Investment is currently underway in the Azerbaijan-Georgia pipeline for export into and through the Black Sea. Meanwhile, indications from the Azeri authorities are already pointing to a preference for the Turkish option for the first main export pipeline. This has been supported by statements from the U.S. Administration, but has yet to translate into a commercial project. No firm decisions have yet been made.

Chart 12

Possible Caspian Export Routes



Conclusions

The 1990s so far have seen a combination of evolution and revolution in the oil markets of Europe and the FSU: evolution in mature Western European consuming markets; a revolutionary surge in North Sea production; transition in Central Europe; revolutionary collapse and stabilisation in the FSU.

The next decade offers a rather different picture. With environmental concerns emerging as a key policy driver, there is a real prospect of a revolutionary shift in Western European oil consumption. Western European - North Sea - oil production is moving out of its revolutionary growth phase and looks set to move towards, first a peak, and later an evolutionary decline. Fiscal regimes will be key determinants of the pace of that decline. But the North Sea looks set to have a continuing impact on the rest of the world. The leading edge technological and managerial advances of the last decade are now being shared and adopted elsewhere and are impacting global oil production. The possibility also remains for Western Europe to lead the world in the development of the 'low carbon economy', although this potential is currently still far from proven.

Central Europe has set off on the catch-up road, and the likelihood is that several countries from that region will, over the next decade, begin to resemble their Western counterparts. But again in contrast to the last decade, Russia looks set to evolve: if political, economic and financial conditions are stable, there is a reasonable likelihood of moderate growth in both oil consumption and oil production and rising net oil exports. This leaves the Caspian with the prospect of a new revolutionary era for oil production and rising exports of oil to the world's consuming markets.

The geographical balance of evolution and revolution looks set to reverse.

Footnotes

[1] Full details of how geographical regions have been defined for the purposes of this paper can be found in the Annex.

[2] Defined here as the United Kingdom and Norway.

[3] *Europe in 2001: Economic Analysis and Forecasts*, DRI (for European Commission Directorate General for Energy DGXVII), January 1998.

[4] A similar point was made recently in a speech by Matthew R. Simmons of Simmons & Company International at The Office Of The Comptroller Of The Currency Senior Management Conference, Houston, Texas, 10 March 1998.

[5] For a more detailed survey of Russian oil production, see CERA Private Report, *The Shock is Over: Why Russian Oil Output has Stabilized*, January 1998.

[6] *International Energy Outlook 1998*, Energy Information Administration, April 1998

[7] Odell, Peter R (1998), *Energy: Resources and Choices*, from *The New Europe: Economy, Society and Environment*, edited by David Pinder.

[8] *CGES Global Oil Report* (March - April 1998), Volume 9, Issue 2, Page 21.

[9] *Financial Times*, 29 April 1998, Page 2.

[10] *A New Deal for Transport: Better for Everyone* The Government's White Paper on the Future of Transport. Department of Environment, Transport and the Regions (DETR), July 1998.

[11] All estimates in this paragraph are taken from "Caspian Oil and Gas: The Supply Potential of Central Asia and Transcaucasia", IEA, May 1998.

[12] Some of the oil will be consumed in the Black Sea region.

Bibliography

British Petroleum Company plc. (1998) *BP Statistical Review of World Energy June 1998.*

Cambridge Energy Research Associates CERA (1998) *The Shock is Over: Why Russian Oil Output has Stabilized*, CERA Private Report, Jan 1998.

Centre for Global Energy Studies (1998) *CGES Global Oil Report* (March - April 1998), Volume 9, Issue 2.

(continued on page 12)

Oil Markets in Europe and the FSU

Department of the Environment, Transport and the Regions (1998) *A New Deal for Transport: Better for Everyone, The Government's White Paper on the Future of Transport*. HMSO, Cmnd 3950, July 1998.

DRI (for European Commission Directorate General for Energy DGXVII) (1998) *Europe in 2001: Economic Analysis and Forecasts*, European Commission, January 1998.

Energy Information Administration (1998) *International Energy Outlook 1998*. U.S. Department of Energy, Washington, April 1998.

Financial Times (1998) "Cities give 'green' light to low emissions vehicles", 29 April 1998.

International Energy Agency (1998) *Caspian Oil and Gas: The Supply Potential of Central Asia and Transcaucasia*, IEA, May 1998.

Odell, Peter R. (1998) *Energy: Resources and Choices*, in *The New Europe: Economy, Society and Environment*, David Pinder (ed), John Wiley & Sons Ltd, 67-90.

Annex

Geographical Definitions

North West Europe
- Austria
- Belgium
- Denmark
- Finland
- France
- Germany
- Iceland
- Republic of Ireland
- Turkey
- Luxembourg
- Netherlands
- Norway
- Sweden
- Switzerland
- United Kingdom

South West Europe
- Cyprus
- Gibraltar
- Greece
- Italy
- Malta
- Portugal
- Spain

Western Europe:
North West Europe + South West Europe

Central Europe:
- Albania
- Bulgaria
- Czech Republic
- Hungary
- Poland
- Romania

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- From energy to the energy service

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- Urban planning and architecture options
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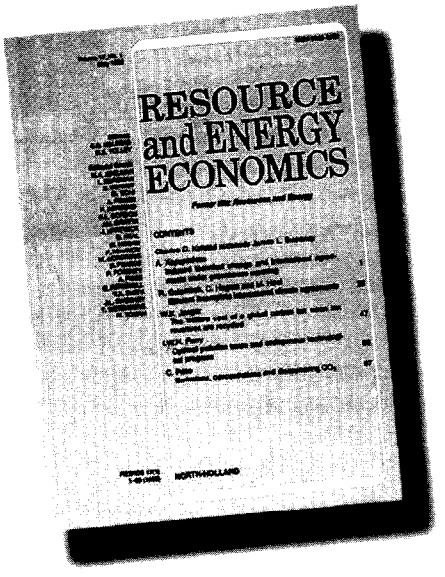

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AA8KAA0416

Grid-Connected Wind Energy Technology: Progress and Prospects

*Brian Parsons**

Even as European wind development continues at a brisk pace, there are hints that a renewed interest in grid-connected wind power is emerging in the United States. The scarcity of new wind projects brought about by uncertainties about restructuring of the U.S. electricity industry and upheavals in the wind industry may have reached its low point in 1997. State mandates, the impending expiration of the federal wind energy production tax credit in mid-1999, and strategic planning by some state and industry officials are fostering efforts to repower existing wind power plants as well as build new ones. Other factors revitalizing the U.S. wind industry include lower wind energy costs, an improved understanding of project financing, and impending technology enhancements. How these factors will play out during and after the transition to restructured electricity markets is far from clear, however. Many factors will play a role in determining wind energy's long-term prospects in the United States and elsewhere. They include new capacity needs, the success of green pricing efforts, whether the U.S. government creates new policies in support of renewable energy, the impact of state renewable energy initiatives, electrification strategies in the developing world, and commitments to curb greenhouse-gas emissions.

Many energy analysts believe there is a major opportunity for wind energy in the U.S. bulk power market. There appear to be few, if any, physical limits in the near term to wind penetration into the grid. Rather, limits appear to be economic. Anticipated improvements in systems operations, energy storage, and wind forecasting will address these limits in the next few years. In the meantime, entry into mainstream U.S. power markets will occur because the public, federal and state officials, and utilities recognize the value added from using wind as an energy resource. Most people recognize wind's value as a fuel saver. Where wind resources and utility loads match reasonably well, wind also has potential capacity value and reliability benefits. Wind can provide fuel diversity to an industry becoming increasingly reliant on natural gas, help power companies comply with environmental regulations, and satisfy customer desire for clean power. As a domestic energy resource, wind also spurs economic development in rural areas, where new wind power plants are most likely to be sited. Wind plants provide long-term income to landowners and boost rents and sale prices while leaving most of the land free for agricultural or ranching purposes. They provide significant property tax revenues to sparsely populated townships, counties, and school districts.

Outside the United States, wind is the world's fastest growing energy resource, with annual growth rates of about 40% per year in Europe since 1991. Worldwide, the amount of installed wind capacity increased 24% in both 1996 and 1997. Last year more than 1500 megawatts (MW) of new capacity was installed around the world; Germany and other European nations accounted for three-fourths of the total. Europe now has about 4,500 MW of installed wind capacity, about three times that of the United States, which added just 11 MW of new capacity in 1997. Germany, Denmark, Spain, the United Kingdom, the United States, China, India, and Mexico are among the active participants in what is now a $1.5 billion per year global wind energy market.

The European Union (EU) has taken the lead in bringing wind technology into mainstream power markets during the past five years. With the European Wind Energy Association's revised installed capacity targets now standing at 8000 MW for 2000 and 100,000 MW for 2020, it is clear that wind is becoming a well established form of power generation. A variety of policy and marketing incentives, together with EU support for research and development, are responsible for wind's rapid inroads into mainstream EU power markets. Incentives include premium prices for wind-generated electricity (in Germany, Denmark, and Spain), binding national targets for increasing wind capacity (in Denmark), bidding processes favorable to wind (in the U.K.), general public funding of national research and development programs, and direct investment subsidies for turbine installations.[1]

U.S. Markets

In recent years, the United States has lagged behind Europe in the promotion of grid-connected wind technology, particularly with respect to policy and marketing incentives at the federal level. Even funding for wind research and development has declined, falling from $49 million in 1995 to $28.6 million in 1997. The depressed U.S. wind market, under capitalization of wind companies, and difficulties with technology have forced several manufacturers into bankruptcy, leaving Enron Wind Corp./Zond Systems as the only manufacturer of large turbines actively competing in the U.S. wind power market. The result has been a near-paralysis in the entry of wind into U.S. power markets, particularly during 1996 and 1997. Between 1995 and 1997, the United States acquired only about 80 MW of new wind capacity. More recently, older turbines in California have begun to be replaced with newer machines to take advantage of the federal wind energy production tax credit. Eligible wind facilities receive a tax credit of $0.015/kWh for the first 10 years of operation. The tax credit applies to new wind power plants and existing facilities that update their wind machines. Eligible facilities must be on line by June of 1999 when the credit expires. There has been debate about extending the tax credit as well as creating a national Renewable Portfolio Standard to support the development of wind and other renewables. However, new federal laws or policies have not been forthcoming. In the private sector, utilities have been reluctant to commit to new power installations of any kind, preferring to wait and see what happens with electric industry restructuring.

The worst appears to be over. Thus far in 1998, wind development activity is greater than at any time since the heyday of the California wind rush in the early 1980s. Three companies, Enron Wind Corp., SeaWest Energy Systems, and the FPL Group, Inc. have announced plans for more than a dozen wind projects totaling more than 800 MW. The projects are scheduled for completion this year or next. The projects include building new wind power plants in Colorado, Minnesota, Iowa, Oregon, Texas, and Wyoming and repowering existing wind facilities near Palm Springs and in the

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Altamont and Tehachapi regions of California. Developers are rushing to refurbish existing facilities and complete new projects before June of 1999 to take advantage of the federal tax credit.

State Mandates

Legislative mandates in Minnesota, Iowa, and Wisconsin are key ingredients in the U.S. wind power renaissance. In Minnesota, the so-called 1994 Prairie Island law required Northern States Power Co. (NSP) to build or buy 400 MW of wind power by 2002 in return for being allowed to store nuclear waste on the site of the utility's Prairie Island nuclear power plant. NSP's first 25-MW wind facility, completed near Lake Benton in southwestern Minnesota in 1994, does not count toward compliance with the mandate. The first phase of the mandated generation, a 107-MW facility, was dedicated in September near Lake Benton on the Buffalo Ridge. A contract for an additional 103.5 MW to be built in the same area was signed in April of this year. Three smaller projects totaling 33 MW are also under construction. NSP plans to release a Request for Proposal for the remaining 156 MW by the year's end. The 1994 law also mandates an additional 400 MW of wind capacity if wind is the least cost option and fits with the requirements of the state's integrated resource plan. NSP contends that because gas turbines cost less than new wind capacity, it should not be required to buy more wind power.

Wind development in Iowa is beginning in earnest, thanks to the state's 1983 Alternative Energy Production law. The law requires the state's regulated utilities to purchase 1.5% of their power from alternative energy facilities. Iowa utilities fought the law in court for more than a decade before reaching an agreement in 1997 to add wind power to their generation mix. Iowa's three largest utilities have signed agreements to purchase power from three wind power plants planned for completion by mid-1999: a 112-MW facility in Buena Vista County, a 76-MW facility near Storm Lake in northwest Iowa, and a 42-MW plant in Cerro Gordo County near Clear Lake. Enron Wind Corp. will build and operate the two larger facilities, while the FPL Group will build and operate the Clear Lake wind power plant. MidAmerican Energy Holdings Company of Des Moines, IES Utilities Inc. of Cedar Rapids, and Interstate Power Co., which serves Iowa, Illinois, and Minnesota, will purchase power from the facilities.

In late spring, the Wisconsin Legislature mandated that four investor-owned utilities (Wisconsin Electric Power, Wisconsin Power & Light, Wisconsin Public Service, and Madison Gas & Electric) add 500 MW of new power generation capacity to ensure statewide system reliability. A minimum of 10%, or 50 MW of this new capacity was set aside for renewable energy sources. In response to the mandate, Wisconsin Electric issued a Request for Proposal in August for 75 MW of renewable power generation, nearly three times its mandated share of 27 MW. The new solicitation is in addition to two wind turbines the utility is installing as part of its "Energy for Tomorrow" green pricing program. Madison Gas & Electric's new 11.25-MW wind power plant, scheduled for completion in 1999 as part of a green pricing program, will also count toward compliance with the new mandate.

Voluntary Initiatives

Perhaps the most intriguing U.S. wind initiatives are coming from the State of Texas. State and utility officials are collaborating on significant renewable energy development, including wind, without being forced to do so by law or regulation. Strong public support for clean energy appears to be driving wind development in Texas, and Texas utilities are responding enthusiastically. The genesis of this support is coming from a new type of opinion poll, called "deliberative polling," being conducted by Texas power companies. The companies invite a small, representative sample of their customers to spend a weekend at company expense learning about and discussing electricity, sources of energy, and the environmental impacts of power generation. What company and state officials have learned from these structured discussions in Houston, Corpus Christi, and Beaumont is that Texans want more renewable energy, from sources like wind, and they are willing to pay a premium price for it. As a result, the Texas Public Utilities Commission has made a commitment to giving customers the choice to buy green power. And, utilities have already undertaken a sustainable energy development strategy founded on traditional supply and demand economics.

The Texas experience promises to show whether wind can deliver profits like any other energy business. The state's substantial wind resource and proud history of energy independence bode well for its forays into uncharted waters of free-market wind development. Currently, 110 MW of new wind capacity is under development in Texas. Central and South West Corporation (CSW) and three of its operating companies (West Texas Utilities Company, Central Power and Light Company, and Southwestern Electric Power Company) are in the bidding process for a large-scale wind power plant south of Odessa. The new facility will be included in the rate base of the three operating companies. CSW, the nation's second largest utility, built a 6.6-MW wind power plant in 1995 in west Texas near Fort Davis under the auspices of the Turbine Verification Program (TVP) sponsored by the Electric Power Research Institute and the U.S. Department of Energy (DOE). York Research Corporation of New York is building a 35-MW wind power plant in west Texas near Big Springs. The new facility, which will sell wind power to the Texas Utilities Company, is an associate member of the TVP. The TVP has also sponsored other, smaller wind projects in Alaska, Iowa, Nebraska, Vermont, and Wisconsin. The new Texas wind power plants join a 41-MW facility in Culberson County developed in 1995 in conjunction with the Lower Colorado River Authority.

Despite the renewed interest in wind in the United States, the long-term prospects for wind in Texas and elsewhere remain uncertain. The impact of electricity market restructuring on renewable energy development is not clear. Nor is the impact of the looming expiration of the wind energy production tax credit. There is substantial debate surrounding the need for federal renewable energy policies such as a Renewable Portfolio Standard, which would mandate a set percentage of renewable energy in all electricity sold. Further, no one yet knows the extent to which new green pricing initiatives will further the cause of wind development. At

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present, individual states are experimenting with a variety of policies and mandates designed to encourage renewable energy development. In the meantime, the federal wind energy program and the U.S. wind industry are focusing on ways to communicate the value of wind to utilities, improve wind technology and manufacturing processes, and lower wind energy costs. Eventually, competitive costs will guarantee wind a strong market share in future power markets.

Costs

Costs for wind energy have declined steadily from $0.25 per kilowatt-hour (kWh) in the early 1980s. Today, wind power plants using new technology have energy costs ranging from $0.04 to $0.06/kWh. New wind plants in Minnesota and Iowa have utility contracts that pay approximately $0.045/kWh. Northern States Power awarded a wind energy contract in April 1998 to Enron Wind Corp. that reportedly includes an energy price of $0.03/kWh. Assuming the Minnesota project is completed on time, this price will be supported by an additional $0.015/kWh federal production tax credit.[2]

The prices quoted above cannot be generalized to every new project, however. Market prices for wind energy vary as a function of project specific factors such as the quality of the local wind resource, the type of financing the project developer can obtain, and project size. With or without an extension of the federal tax credit, wind energy costs are expected to decline gradually over the next decade as a result of incremental improvements in technology and increasing production volumes. Without a federal tax credit, however, lower wind costs will be necessary to enable the technology to compete head-to-head with new natural gas plants, which have a bus bar power cost of $0.025 to $0.03/kWh.

Because wind has high front-end capital costs, ownership and financing strategies have a significant impact on the cost of energy. Financing strategies differ among public power companies, which include municipal utilities and rural cooperatives; investor-owned utilities; and independent power producers. Wind projects are easier and less expensive to finance if the project's owner can take advantage of the low-cost financing available to large utilities.[3,4] Public power companies can secure the lowest cost financing. Neither municipal utilities nor rural electric cooperatives are subject to federal income or local property taxes. They can finance a wind power plant with 100% debt financing by selling tax-free bonds. In contrast, investor-owned utilities and independent power producers must have 20%-to-50% equity to secure financing. However, the investor-owned utilities still have a significant financial advantage over an independent power producer. The utility can rely on corporate financing for a wind project and either include the wind power plant in its rate base or offer wind power at a premium price to its customers. Because independent power producers typically secure financing on just one project (rather than on a pool of projects or total corporate assets), lenders consider their projects to be high risk. Consequently, independent power producers pay higher interest rates on loans and have shorter payback periods on debt. Until independent power producers can obtain similar financing terms to large utilities, their wind projects will inevitably be more costly. Table 1 compares the cost of wind energy for three types of project ownership and two wind power classes.[5]

Table 1
Impact of Project Financing on Wind Cost of Energy
Wind Cost of Energy (1998 constant ¢/kWh)

Wind Power Class	1998	2000	2005	2010
PUBLIC POWER COMPANY				
Class 4	3.87	2.67	2.01	1.86
Class 6	3.12	2.20	1.67	1.56
INVESTOR-OWNED UTILITY (Corporate Finance)				
Class 4	5.80	3.92	3.04	2.78
Class 6	4.54	3.13	2.47	2.28
INDEPENDENT POWER PRODUCER (Project Finance)				
Class 4	7.35	4.92	3.89	3.66
Class 6	5.67	3.87	3.12	2.90

The rapid growth of the wind industry in Europe has opened the door to more favorable financing arrangements than exist in the United States. European banks have become familiar with wind project development and no longer see wind as high risk. Some are even willing to assume project risks with as little as 20% equity financing. Several nations offer government-backed loan guarantees. Cooperative ownership of wind projects is a novel financing arrangement widely used in Denmark. There, approximately 5% of the population own shares in a wind power project. Cooperative ownership provides project financing, educates the public on the benefits of wind energy, and ensures significant policy support for wind energy development.

Technology & Industry Status

Technology enhancements and increasing volume production for wind turbines should lower the cost of wind energy by about 40% from current levels by 2030.[6] Government-sponsored research and development are expected to play a key role in developing technology enhancements. The U.S. wind industry is still small enough to need shared research, development, and testing to improve such turbine subsystems as rotors and towers. Policy commitments to renewable energy in Europe are assuring this support for the European wind industry. Most analysts agree that the resultant technology improvements will be evolutionary, not revolutionary. Improved technologies are predicted to account for one-fourth to one-half of the projected cost reductions for the installed cost of new machines. The remainder of the projected cost reduction will come from increasing volume production. Turbine costs are projected to fall by about 5% every time industry production doubles, with four to five doublings expected by 2030.

A new generation of U.S. utility-scale wind turbines is expected to be commercially available by about 2002. The turbines will feature taller towers and larger rotors, both of which will help lower overall costs. Other technical improvements, such as larger, multi-speed or variable-speed generators, variable pitch rotors, and advanced power electronics for improved power quality and sophisticated control systems, will enhance overall turbine performance. However, because many technical improvements currently on the drawing board will require new, custom-made turbine components, they won't significantly lower costs until volume production begins to increase after 2005.

Taller towers will be responsible for the most significant gains in turbine performance and cost reduction. Wind speed increases with height above the ground. Taller towers expose turbines to stronger winds, enabling them to produce more electricity. Winds aloft are also more consistent, which

increases the percentage of time a machine produces power. Reductions in turbine weight combined with innovative tower designs are making it possible to build taller towers at reduced cost. Between now and 2005, average tower height is expected to increase from 40- to 50-meters (m) to 70 m. Placing rotors at higher hub heights increases the energy output of the turbine. In addition, new and larger rotors are being designed to maintain high performance efficiency over a larger range of wind speeds, in particular the lower wind speeds. For instance, Enron Wind Corp./Zond Systems now offers a custom rotor diameter for its new Z-750 wind turbine. The turbine comes with a 46-m, 48-m, or 50-m diameter rotor designed for excellent, good, or moderate-to-low wind regimes, respectively.

There is a limit to cost reductions associated with larger machines, however. Turbines ratings much larger than 1 MW make economic sense only for offshore installations, which require very expensive foundations. The logistics of installing big machines several kilometers offshore drive installation costs up 20% to 30%. European industry analysts contend, however, that because winds are stronger offshore, increased power production will offset the high installation costs over the life cycle of an offshore facility. Either way, very large turbines are likely to be cost effective for this application. Because the United States has an abundance of sparsely populated land with excellent wind resources, next-generation turbine development in this country emphasizes the more affordable 1-MW machines. In contrast, there are major government-sponsored turbine development programs underway in Europe that emphasize much larger machines than U.S. designs. Not surprisingly, densely populated European countries are running out of potential wind development sites with good wind resources. Because these countries have generous market incentives for wind development, they are pursuing significant offshore wind development for larger machines.

Generally speaking, improvements in turbine performance and cost after about 2005 are likely to be incremental. Lower cost power electronics, more sophisticated turbine controls, and advanced designs that allow machines to avoid damaging wind forces will be introduced. Taller towers will continue to increase energy production with only a modest increase in installed costs. The introduction of low-speed, direct-drive generators should result in large cost savings by eliminating costly gearing and transmission. By 2005, permanent magnet, direct drive generators should be available for 1-MW machines, helping to lower costs.

European turbine manufacturers provide the bulk of private research and development investment as well as supply most of the world market for utility-scale wind turbines. Enron Wind Energy Corp./Zond Systems is the only U.S. turbine manufacturer currently competing in this market. The firm's new Z-750 turbine is the first U.S. machine in several years to be installed in large numbers in utility wind power plants. Enron Wind, which purchased California turbine manufacturer Zond Systems in 1996 and German turbine manufacturer Tacke in 1997, appears to be positioning itself to take advantage of domestic and international markets for wind technology. The firm has announced plans to develop a 1-MW next-generation turbine by 2002. Another U.S. firm, The Wind Turbine Company, has also announced plans for a new 1-MW machine. Both Enron Wind and The Wind Turbine Company are participating in DOE's Next-Generation Turbine Development Program. European firms currently have approximately 10 turbine designs in the megawatt range with commercial prospects.[7]

U. S. Market Trends

Electric industry restructuring, global efforts to combat climate change, and the increasing financial competitiveness of wind technology will play major roles in shaping future wind markets. The electrification of the third world and growing concerns about air quality are also likely to impact wind markets. In the United States, worry about energy security, the need for new generating capacity, the fate of the wind energy production tax credit, the impact of fledgling green marketing programs, and the fate of proposed federal legislation favorable to renewables will influence the rate and extent of wind development. Wind development in Europe will likely continue at a rapid pace during the next decade despite the uncertainties inherent in future wind markets. Wind development in the United States, however, is going to be much harder to predict.

Restructuring of the U.S. electricity market has gotten underway in a more or less piecemeal fashion. On April 1, the nation's largest electricity market, California, opened its gates to competition, with Pennsylvania and Massachusetts following close behind. Within five years, most of the country will have undergone some form of restructuring. Restructuring will primarily allow competition in electrical generation. This competition will almost certainly bring down the cost of electricity, which could pose problems for wind development. Wind's environmental benefits will not necessarily figure in pure market-based decisions. A new wind power plant costs more than a new natural gas fired power plant. In addition, restructuring introduces significant risk into the financing of any kind of new power generation. In a restructured environment, power purchase contracts will typically last two or three years, five years at the outside. Debt repayment for new wind generation capacity, on the other hand, could last anywhere from 10 to 20 years. The discrepancy between income guarantees and debt repayment schedules will seriously impact wind development because it is capital intensive and relies on up front financing. These factors will make it particularly difficult for wind development to evolve through merchant plants, which will be built on speculation to supply electricity for spot markets. In gauging the seriousness of these considerations, it's important to note that the mere threat of impending restructuring brought new power generation, including wind development, to a virtual standstill in 1996 and 1997.

The good news is that restructuring also gives customers choices about suppliers and the resources used to generate power. Because utility customer surveys consistently show that more than two-thirds of Americans support the development of renewable energy, wind may fare better under restructuring than would be predicted in terms of cost alone. In addition, restructuring will give electricity suppliers the opportunity to bundle power from renewables with other valued products and services. For instance, the cost savings inherent in bundling cable TV, internet services, and electricity would allow enterprising firms to offer green power at no extra cost. It's simply too early to know how things will

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evolve, particularly since the federal government could weigh in at any point with policies to support renewable energy or curb greenhouse-gas emissions.

If the United States decides to meet the 1997 Kyoto Protocol, it would require a shift in energy policy and in the direction of the U.S. energy economy. At the present time, electricity generation is responsible for 36% of man-made carbon emissions.[8] Any commitment to curbing these emissions would, of necessity, accelerate the commercialization of renewable technologies.[9] As one of the most cost-effective of the renewable options, wind technology is in an excellent position to benefit from such a commitment. Significant carbon offsets are possible in 34 of 50 states that have high quality wind resources. In addition, wind is an important technology for rural electrification in regions of the developing world with good wind resources. The provisions of the Kyoto Protocol allow industrial nations to meet their goal of reducing carbon emissions by assisting developing countries in finding development paths that replace fossil fuels with renewables. Thus, a U.S. commitment to reducing carbon emissions would likely to stimulate wind markets at home as well as in South America, China, India, and the Pacific Islands.

The replacement of fossil fuel generation with grid-connected wind energy systems or wind-diesel hybrid village power systems could help address growing concerns with air quality in the developing world. Air pollution from electricity generation and transportation endangers human health and agriculture as well as threatening climatic stability. For this reason, environmental issues will continue to drive wind development until wind can directly compete with natural gas. So long as natural gas supplies remain plentiful, inexpensive, and readily available, the pace of wind development will likely remain at current levels, and concerns about energy security will stay on the back burner. However, as the industrial world increasingly turns to natural gas to meet tougher emissions standards, supply disruptions or price hikes could become more commonplace. Should this occur, energy security could rapidly become a driver for new wind development.

New Capacity Needs

The need for new capacity in the United States is going to encourage new wind development. Load growth has caught up with capacity surpluses created more than a decade ago in many areas of the country, including Texas and Colorado. Public Service Company of Colorado encountered unanticipated power shortfalls during a recent summer heat wave. At the time, the utility was basking in the success of its WindSource green marketing program, which had garnered a premium of more than $1 million to purchase power from the utility's new 12-MW Ponnequin wind power plant. By September, the utility had agreed to build an additional 25-MW wind power facility to help meet its new capacity needs. Once the utility recognized that customers wanted green power, it decided to include wind in its rate base. As discussed earlier, Texas's Central and South West Corp. have also undertaken significant efforts to develop wind power.

Electric industry restructuring appears to be encouraging utilities to retire their nuclear power plants early. About 20% of the nation's nuclear power facilities will be decommissioned sooner than planned, and more than half will be off-line by 2020.[10] Utilities plan to take advantage of the stranded cost recovery allowed under most state restructuring rules, then shut down these expensive and unpopular power plants. Natural gas and renewables such as wind will be brought on-line to replace them. In contrast, restructuring appears to favor keeping older coal-fired plants on-line because they are so much less expensive to operate than building new power plants. The fact that these older plants are responsible for significant emissions of carbon dioxide and air pollutants could also bode well for wind development. Utilities that choose to keep older, polluting power plants on-line are going to have to invest in clean power generation themselves or purchase emissions credits in order to comply with national air quality standards. Either way, there may be added incentives for investments in wind generation.

Green Power Marketing

Approximately 15 utilities offer either contribution or energy-based green pricing programs for wind energy (see Table 2). In contribution programs, customers contribute to a fund for renewable energy project development in a utility's service territory. The projects funded may or may not supply green power to the customers paying for them. In energy-based programs, customers purchase all or part of their electricity from renewable resources. Green power is typically sold in blocks, such as 100 kWh per month, or as a percentage of total consumption. In most instances, consumers pay a premium price for it. Most utility green pricing programs attract less than 3% of residential customers and even fewer commercial and industrial sponsors. However, pilot programs for retail competition in Massachusetts and New Hampshire demonstrated that environmental factors do influence consumers to pick a particular electricity provider. Successful green pricing programs, such the Colorado WindSource program, benefit from the support of local environmental groups who work to generate customer commitment to new wind development.

A major issue being addressed in restructuring legislation is disclosure. Good disclosure requirements should go a long way toward keeping green marketing and pricing efforts honest. Rather than asking consumers to get an in-depth education in electricity generation and marketing, most disclosure rules favor something like the nutritional labels on food. Electricity "labels" would provide information on cost, the resources used to generate power, and information about emissions produced. The Green-e program, a well-respected disclosure initiative, was created in 1997 by the San Francisco-based Center for Resource Solutions. The Green-e logo certifies environmentally sound green power products and helps create customer confidence in renewable energy through a code of conduct, disclosure provisions, and consumer education. The Green-e logo assures the public that a specific green power product consists of at least 50% electricity generated from such renewable resources as solar, wind, geothermal, biomass, or small hydro. The other 50% of the electricity cannot have produced more pollution than the average generation mix in California, which consists of 16% coal, 32% gas, 27% hydro, and 9% renewables. To date, California and Pennsylvania participate in the Green-e program. Several other states have mandated their own information disclosure and consumer education requirements. Suc-

cessful green pricing programs and the Green-e program are definitely bright spots in the current U.S. wind renaissance. However, it is probably overly optimistic to expect green pricing alone to foster the development of a long-term, robust U.S. wind market.

Table 2
Green Pricing Programs Offering Wind Power

Utility	Size	Premium (¢/kWh)	Start Date	Notes
Bonneville Power Administration	N/A	1.0	1998	Power from new wind project goes into pool of "environmentally preferred resources."
Cooperative Power Association	2.0 MW	2.0	1998	New project contract for distribution cooperatives
United Power Association	0.7 MW	2.0	1997	Buys wind energy from Cooperative Power for "It's A Breeze" program
Fort Collins Light & Power	1.2 MW	2.0	1997	Two 600-kW turbines (Medicine Bow, WY) "Wind Power Pilot Program"
Lincoln Electric System	0.75 MW	6.0	1999	New project
Los Angeles Department of Water and Power Board	20 MW (?)		1999 (?)	"Green Plan" customers pay $3-$5 extra per month to develop new wind projects
Madison Gas and Electric	11.25 MW	4.0-5.0	1999	New project
Moorhead Public Service	0.75 MW	0.5	1999	New project "Capture the Wind"
Public Service Company of Colorado (PsCo)	12-20 MW	2.5	1998	12-MW facility under construction in 1998
Holy Cross Energy	2.75 MW	2.5	1998	Wholesale purchase from PsCo
Colorado Springs Utilities	0.5 MW	3.0	1998	Wholesale purchase from PsCo
Southwestern Public Service (New Mexico)	0.7 MW	3.0	1997	"WindSource" program initiated as condition of regulatory approval of new gas turbine
Traverse City Light and Power	0.6 MW	1.58	1996	One 600-kW turbine "Green Rate"
Western Resources	1.5 MW		1998	Two 750-kW turbines
Wisconsin Electric Power Co	1.2 MW	2.0	1998	New, two-turbine project part of "Energy for Tomorrow" program

State and Federal Policies

State and federal laws and regulations will dictate the pace and ultimate success of green power marketing. At the present time, policies favoring wind development are coming from individual states where restructuring is proceeding at a rapid pace. More than 10 states have laws, regulations, or other incentives for the development of renewables such as wind. The two most popular state mandates are Renewable Portfolio Standards, which specify that a set percentage of electricity must come from renewable resources; and systems benefit charges, which are levied on utility customers. Systems benefit charges can be used for direct subsidies to renewable energy projects, for research and development, for energy efficiency, or for low-income customers. Both the Renewable Portfolio Standard and the systems benefit charge establish a minimum public obligation for funding the development of renewable energy in a changing electricity industry. Other state policies promoting renewable energy include purchase incentives (California), government purchase policies (Nebraska and Colorado), and utility green pricing service requirements (Texas). Whether state regulations actually encourage customers to purchase green power or suppliers to invest in it appears to depend on the rules themselves. Overly complex regulations, particularly those that provide little incentive for customers to switch to new suppliers, can hinder the very technologies they were designed to promote. For example, California gives residents a guaranteed rate cut with no incentive to change electricity supplier. In contrast, Pennsylvania offers rate cuts only if customers actively choose an electricity supplier. Thus, in Pennsylvania customers can choose green power and save money. Not surprisingly, more than a million people have opted to do so, whereas only about 80,000 California customers (less than 1%) have taken advantage of green power offerings there.

Many state restructuring laws include provisions for net metering. Net metering policies allow individual utility customers to install a renewable energy system such as a wind turbine on their side of the electric meter and be compensated at retail rates for the electricity they produce. Net metering systems calculate monthly customer charges by subtracting the value of some or all of the electricity fed into the grid from the amount of electricity used. The process encourages consumer investment in wind technology by improving the economics of individual wind systems connected to a utility grid. Without net metering, customers pay full retail rates for electricity they use from the grid, but are reimbursed for electricity they sell at the utility's avoided cost, which is significantly less than retail rates. Because net metering is only available to rural residents in 11 states, its impact on wind development has been limited thus far.

Although state policies are currently defining restructuring, industry analysts believe that federal policy and marketing incentives will be necessary to ensure the survival of the U.S. wind industry. They contend that, should Congress allow the production tax credit to expire in June 1999, wind development in the United States could come to a virtual standstill.[11] Because wind energy is significantly more expensive than natural gas, it is not clear that green power marketing alone could sustain the current momentum of U.S. wind development. In contrast, a temporary extension of the tax credit for five years would help shore up a weakened U.S. wind industry, encourage the installation of an additional 1000 MW of wind, and help position U.S. firms to capture about a quarter of the projected international wind market by 2005. However, prospects for an extension remain uncertain despite support from the Edison Electric Institute and 12

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Grid-Connected Wind Energy *(continued from page 19)*

members of the House Ways and Means Committee. Congress is apparently not going to consider a tax bill or other legislation to extend the tax credit this year.

Little is happening on the federal level right now with respect to restructuring legislation. Four restructuring bills, along with the Administration's Comprehensive Electricity Competition Plan, were introduced and discussed during the 105th Congress. Each would have created a national Renewable Portfolio Standard. The Renewable Portfolio Standard is a flexible, market-driven policy to accelerate market penetration of renewable technologies like wind that are already near commercialization. The various proposals would have required renewable energy resources to produce between 4% and 10% of the nation's electricity by 2010. Most included provisions for tradable renewable energy credits, which would allow electricity generators to purchase compliance if they chose not to invest directly in renewable energy themselves. If enacted, a national Renewable Portfolio Standard would create certainty and stability in domestic wind markets. Supporters of the standard argue that restructuring is unlikely to create market opportunities for renewable energy and may actually increase competition to the point renewable energy cannot compete. They believe that a federal policy is necessary to keep renewable energy from being shut out of tomorrow's electricity markets. Opponents of the standard are concerned about the possible costs of implementing it and believe it is at odds with creating a truly competitive market. Because Congress failed to act on any restructuring legislation this session, the fate of wind development remains uncertain. Because this year's pending bills died at the end of this session, a new Congress will resume debate on restructuring next year. For wind to succeed in tomorrow's electricity markets, there appears to be a need for supportive policies during and after the transition to electric industry restructuring and for market rules favorable to renewable energy technologies. Such policies could include net metering, systems benefit charges, increased support for research and development, and various tax incentives, including an extension of the production tax credit.

Footnotes

[1] "Wind Energy in Europe-The Facts." Executive Summary. European Wind Energy Association - Publications. http://www.ewea.org/summary.htm (25 August 1998).

[2] "How much does electricity from wind turbines cost?" American Wind Energy Association FAQ: Cost of Wind Energy. http://www.igc.apc.org/awea/faq/cost.html (25 August 1998).

[3] Wiser, R. and Kahn, E. "Alternative Windpower Ownership Structures: Financing Terms and Project Costs." From Wind Energy Weekly #709, 12 August 1996. American Wind Energy Association FAQ: Cost of Wind Energy. http://www.igc.apc.org/awea/faq/cost.html (25 August 1998).

[4] The Electric Power Research Institute. *Renewable Energy Technology Characterizations*. TR-109496. Palo Alto, CA: Electric Power Research Institute December 1997. Prepared by the Office of Utility Technologies, Energy Efficiency and Renewable Energy, U.S. Department of Energy and EPRI.

[5] Seven wind power classes are used to express the energy contained in wind, with Class 1 containing the least energy and Class 7 the most. To date, the nation's abundant Class 4 winds are the least energetic winds commonly harnessed for wind power. The high-energy Class 5 and 6 winds are more economical to harvest, but less abundant and often farther away from population centers where electricity is needed.

[6] The Electric Power Research Institute. *Renewable Energy Technology Characterizations*. TR-109496. Palo Alto, CA: Electric Power Research Institute December 1997. Prepared by the Office of Utility Technologies, Energy Efficiency and Renewable Energy, U.S. Department of Energy and EPRI.

[7] "Wind Energy in Europe-The Facts." Executive Summary. European Wind Energy Association - Publications. http://www.ewea.org/summary.htm (25 August 1998).

[8] Swezey, B. G., Houston, A. H., and Porter, K. L. "Green Power Takes Off with Choice in Electricity." *Public Utilities Fortnightly* August 1998; pp.46-51.

[9] Flavin, C. and Dunn, S. *Climate of Opportunity: Renewable Energy After Kyoto*. Issue Brief No. 11. Washington, D.C.: Renewable Energy Policy Project July 1998.

[10] "Nuclear Power." Energy Information Agency Market Trends - Electricity. 1997. http://www.eia.doe.gov/oiaf/aeo98/ele_nuc.html (29 September 1998).

[11] Cadogan, J., Personal Communication. Department of Energy, Washington, DC, 29 September 1998.

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The U.S. Strategic Petroleum Reserve And The Saudi Connection

*By Mamdouh G. Salameh**

When in April 1996 the Congress authorized the U.S. Administration to sell 12 million barrels (mb) of crude oil from the Strategic Petroleum Reserve (SPR), the Federal government-owned and controlled crude oil stockpile, many influential voices in Washington expressed deep concern about the sale at a time of growing U.S. dependence on oil imports particularly from the Gulf region.[1] They could not, however, have been aware that 7,000 miles away the Saudis were virtually completing the construction of their own Strategic Petroleum Reserve (SSPR) with storing facilities for one billion barrels of crude oil and product for their own use and the use of their closest ally, the United States. Nor could they have been aware of the length and breadth of cooperation between the United States and Saudi Arabia and the extent of what has been termed the 'mutuality of interests' between them.

Success of the SPR

For more than two decades United States petroleum policy has rested on two pillars:

- the ability of the military to protect, defend and, if necessary, take back the oilfields of the Gulf states.
- the SPR, set up in 1974, which acts as an insurance policy to mitigate the impact of a supply disruption on the economy.

These twin pillars have ensured a plentiful and uninterrupted source of oil for the United States. The policy worked. During the Gulf War in 1991 – the only time it was specifically used for the purposes it had been designed to serve – SPR sales provided an instantaneous counterforce to an expected market panic that could have taken place at the outset of the war.

Following the Gulf War sale, the pressure of mounting U.S. Federal government budget deficits began to offset a standing legislative requirement to fill the SPR to 750 mb at the rate of 7,500 barrels per day (b/d). The last purchase of oil for the SPR was made in 1994. Then, in April 1996 Congress passed the Omnibus Appropriations Act which directed the Department of Energy to sell $227 m worth of oil to allow the achievement of the overall budget target for the year. Also contained in the Bill, as part of the 1997 Administration Budget, was a proposal that the SPR sell $1.5 bn of oil in 2002.[2]

The SPR cover, which is calculated in terms of the number of days' imports that it holds, has been declining in the face of rising oil imports and this had been attributed to fiscal pressures. Private industry crude oil stocks have also been declining but for different reasons. The adoption of 'just-in-time' inventory management techniques by the oil industry has led to a reduction in private stocks of 100 mb between 1995 and 1996 alone.[3]

If, however, U.S. crude oil imports continue to rise, as most analysts predict, the effectiveness of the SPR will decrease further and, at some point, decreasing stock levels will undermine the U.S. advocacy that other OECD governments should build and hold strategic oil stocks.

In 1997 net crude oil imports accounted for more than 50 percent of the US oil needs, or 8.93 million barrels per day (mbd) of which 58 percent came from the Middle East.[4] Although there has been some diversification in supply sources, imports in the year 2000 could account for 66 percent of domestic crude requirements, or 12.95 mbd, three-quarters of which will also come from the Middle East.

The American Petroleum Institiute (API) believes that the SPR oil should be made available when an emergency exists but should not be used to dampen price increases or to balance Federal budget deficits. The current SPR holdings, about 575 mb, represent only 64 days' supply of imports when it should provide 90 days of import coverage to satisfy standing legislative requirements.[5]

Dr. John Lichtblau, Chairman of Petroleum Industry Research Association (PIRA) estimates that a supply disruption would cost the U.S. economy hundreds of billions of dollars whereas the cash infusion provided by selling the reserve would come to only $8 bn to $12 bn. He goes on to warn that even if the SPR volumes were to remain at present levels, they will be sufficient to cover less than 60 days of the Energy Information Administration's projected net imports in 2000.[6]

The Saudi Connection

The Saudi authorities originally conceived of a project to store vast quantities of oil as a strategic reserve, from which they could pump in the event of disruption to either their own oilfields or those of their neighbours. That was in the years following the Iranian Revolution and the feared cut-off of oil exports through the Strait of Hormuz. Since then, much has changed. The East-West pipeline from the Eastern Province oilfields to Yanbu on the Red Sea has proved its worth within the Kingdom, whilst a host of other pipelines were built to connect Iraq to Western markets, bypassing the strait.

During the pipeline building era of the 1980s Saudi Arabia studied rock storage in depth. Engineering consultants and companies from France, Canada and Scandinavian countries all contributed to studies and assessments intended to determine the practicality of constructing a set of storage facilities that might hold as much as one billion barrels (bb) of crude oil – the equivalent of several months exports.[7]

Neither the Saudi government nor any of the companies involved with the project was prepared to acknowledge publicly their role in the project. In 1987 a decision was taken to proceed with the project but few details were published. Estimates of the project were put at $3.9 bn and agreements were reached on payment in oil. What was not clear was just what it was that the Saudis intended to construct.

The intention was to construct storage facilities for both crude oil and product in giant underground caverns carved out of the rock. Actual construction work on the Saudi caverns appears to have begun in about 1988/89. But again, little public information was given on the subject.

Then came the Kuwait crisis. The Saudis were anxious, during the run-up to Desert Storm, to show that they, too,

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[1] See footnotes at end of text.

were playing their part in providing the allied forces with the fuel necessary to wage a comprehensive war with Iraq. In January 1991, just 48 hours before the allies began their aerial bombardment of Iraq, a U.S. scientist involved in the Saudi project was authorized to disclose some basic details. This reserve, he said, was considered very necessary to the security of Saudi Arabia and unlike the U.S. SPR, was geared to the storage of product fuel - not crude oil.[8] The Saudis did not need to store crude oil but they have seen how vulnerable their refineries were to air attacks during the Iran-Iraq War.

The Military Nature of the Saudi SPR

By 1993, work was known to be proceeding at five locations, while a sixth had been identified as a further site. These were: Al-Kharj, south of Riyadh; Bahrah, near Jeddah; Medina, in the Hijaz and Khamis Mushait near the border with Yemen. Site surveys were reported to have been completed at Qassim in Central Arabia and at Hafr al-Batin, near the Iraqi border.

For some time, it had been clear that this was primarily a military project, although sources said that fuel storage would cover civilian as well as military needs. The storage facilities at Al-Kharj were completed in 1996 while those at Bahrah should be ready in 1998. Work at Medina, Khamis Mushait, Hafr al-Batin and Qassim is still proceeding.[9]

There are some indications that the project is proceeding at a slow but steady space.

Originally, it was envisaged that the Saudis would allocate 300,000 to 350,000 b/d of oil to pay for the project, with completion envisaged by 1998. Yet actual physical construction has now been going for about nine years and the timetable would seem to indicate that the construction of all six facilities will not be completed until the turn of the century. Allocations for the project also appear to have been reduced to 200,000 b/d.

The choice of sites illustrates the project's military importance. Al-Kharj is one of the Kingdom's major air bases. Khamis Mushait and Hafr al-Batin are the sites of the two military bases guarding the Yemeni and Iraqi frontiers respectively. The other three are on, or close to the existing pipeline network.

Now that work is close to completion, the Saudis are no longer secretive about it. This should mean that if ever Saudi Arabia and its closest allies, notably the United States, have to mount a later-day version of Desert Storm, then the refuelling facilities will be there, even in the event of a direct assault on the Kingdom. It also means supplementing a falling American SPR with a full Saudi one, thus enabling the U.S. government to periodically sell some of its SPR oil to balance the Federal budget without undermining its energy security.

This is what Sheikh Ahmed Zaki Yamani has termed the 'mutuality of interests' between Saudi Arabia and the United States.

Footnotes

[1] Mamdouh G. Salameh, "Is A Third Oil Crisis Looming Before the End of the1990s?", IAEE *Newsletter*, Fall 1996 issue, p. 26.

[2] Peter S. Adam, "Questions Concerning the U.S. Strategic Petroleum Reserve", *Petroleum Review*, London, September 1996, p. 413.

[3] Mamdouh G. Salameh, "Crude Oil Prices on an Upward Trend", IAEE *Newsletter*, Summer 1997 issue, p. 10.

[4] BP *Statistical Review of World Energy*, 1998.

[5] Peter S Adam, "Questions Concerning the U.S. Strategic Petroleum Reserve" p. 414.

[6] Ibid., p. 414.

[7] John Roberts, "Saudi Storage - Between a Rock and a Hard Place", *Petroleum Review*, August 1994, p. 358.

[8] Ibid., pp. 358-359.

[9] Petroleum Argus, various issues, 1993-94.

International Association for Energy Economics

Student Scholarships

The Council of the IAEE is seeking nominations for 1999 IAEE Student Scholarships. The scholarships have been established in order to reward and support the studies of outstanding students of energy economics, especially those normally resident in emerging economies.

It is planned to make a maximum of 5 awards of US$2,000 each for 1999. The successful recipients will be studying energy economics or a related discipline at an internationally recognised university. They will also receive free membership in the IAEE for five years and admission to one IAEE or IAEE affiliated international energy conference.

The awards will be made by a committee of IAEE Council members comprising Prof. Peter Davies (British Petroleum, London), Dr. Michelle Michot Foss (University of Houston) and Dr. Jean-Philippe Cueille (IFP School, Paris). Their decisions will be final. A list of award recipients will be published in the IAEE Newsletter and posted on the IAEE internet site (www.IAEE.org).

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Applications should be accompanied by a brief explanation as to why the applicant considers themselves worthy of the award together with a letter of recommendation from the student's supervisor (in confidence if desired). Applications will close 1 February, 1999 and awards will be announced by 1 April 1999 at the latest.

UK Opens Residential Market To Competition

*By Fereidoon P. Sioshansi**

After months of speculation and delays, competition has begun to be phased in to the remaining 24 million small customers in England and Wales. The process, which started in April 1990 with the largest customers, was extended to medium sized customers in 1994, and is now being offered to the remaining small customers (see accompanying table). By end of June 1999, if all goes well, all customers in England & Wales (E&W) will have the option to choose their supplier.

Some 750,000 customers currently served by Eastern Electricity, Manweb, Scottish Power, and Yorkshire Electricity were initially opened to competition. Early reports indicate that some 10,000 customers in these areas have thus far registered to switch suppliers. The customers are being lured away with all sorts of promotional and marketing gimmicks, and promised savings. According to Professor Stephen Littlechild, the industry regulator in charge of OFFER (the Office of Electricity Regulation), average price savings of 8 percent are being offered to motivate residential customers to switch suppliers. Using 8 percent as an average figure, it amounts to approximately US$30 off a typical customer's annual electricity bill of US$390. Small commercial customers are getting discounts of approximately 12 percent, according to OFFER's preliminary estimates. In some cases, the savings are far greater (see second accompanying table).

Nationwide, "well over 1 million domestic customers and small businesses" are reported to have signed up to change their suppliers. This, according to OFFER, represents roughly 5 percent of the market (by number of customers). By Christmas, some 7 million customers will have the option to shop around. Speaking to reporters, Professor Littlechild, who has been severely criticized for anything and everything that went wrong with privatization over the past 8 years, was elated at the early results. He indicated that the prices for domestic customers had already dropped due to competitive pressures. He predicted that the number of switchovers will continue to rise as new areas of the country are opened to competition and as "customers become more accustomed to exercising choice."

In Stages ... Phased Introduction of Competition in England and Wales

Sites Allowed Competitive Supply	Date	Number of Customers	Consumption (TWh)
Above 1MW	1 April 1990	5,000	75 TWh
Above 100 kW	1 April 1994	50,000	115 TWh
All	1 April 1998*	23,000,000	245 TWh

* The original opening was postponed to September 1998. Moreover, competition will be spread over a year with the full market open by the end of June 1999.

Moreover, Professor Littlechild expects to see more – and presumably better – choices as a number of newcomers enter the business of electricity retailing, with estimated annual revenues of US$15 billion. These new entrants include supermarket chains, petrol stations, financial service companies, and who knows what else. Professor Littlechild stated the obvious when he said, "The mere fact that customers can exercise choice means that companies will have to become more competitive and offer lower prices and better services if they want to retain their market." It is a fitting final act for the chief electricity regulator who will be leaving his post shortly. There are indications that the two main regulatory agencies in charge of electricity (OFFER) and gas (OFGAS) will be combined into one.

Savings Offered to Customers to Switch Suppliers

Annual discounts offered to customers to switch suppliers, in US $.*

Area Existing Supplier	Chester Manweb	Hull Yorkshire	Motherwell Scottish Power	Norwich Eastern
Typical Annual Bill	408	363	401	368
Savings by switching to:				
British Gas Trading	33	18	32	26
Eastern Energy	17	12	8	—
ScottishPower/Manweb	—	11	—	26
Yorkshire Electricity	21	—	(8)[1]	26

Source: Office of Electricity Regulations (OFFER).

* An approximate conversion rate of 1.50 has been assumed.
[1] increased cost.

These early results are very different than those experienced in the newly opened markets in California, Massachusetts and Rhode Island, where relatively few of the small customers have switched thus far. There are several reasons for the differences:

- No automatic savings – Aside from an average 6 percent price reduction imposed by OFFER in April, there are no legislatively mandated rate reductions available to customers in E&W. Customers must switch (or renegotiate with their incumbent supplier) to get a price reduction. By contrast, in California, for example, most small customers are better off to stay with their incumbent utility distribution company or UDC. They get an automatic and painless 10 percent rate reduction by doing absolutely nothing. This provision has made it nearly impossible for the competing electricity supply providers or ESPs to lure small customers away, profitably. No wonder Enron made a big fuss when it announced that it was pulling out of California's residential market.
- Customers already used to competition – since privatization and introduction of competition in the electricity sector started in 1990 and has been gradually phased in, more customers may be accustomed to the idea of shopping around for competitive suppliers than in the newly opened U.S. markets. One recent U.S. public opinion survey conducted by RKS Research & Consulting, for example, found that outside California, more than half of the US population "is unaware of electric industry restructuring." Oblivious may be a better substitute for unaware.
- Gas vs. electric competition – The recent opening of the gas

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market in the UK and the onslaught of competition, marketing and advertising in that market has probably conditioned customers in E&W for the electricity market. As further explained below (see reference to Centrica), the electricity and gas companies have been going after each others' customers energetically. The competition in the natural gas market in the United States, in contrast, has been tame and uneventful in most areas.

- Satisfied customers don't switch - Perhaps - this is pure speculation – some of the PESs in E&W have not been up to snuff in providing customers with good service. The RKS research mentioned above, for example, concludes that in California, (small) customers have not switched in large numbers – despite their awareness of their ability to do so – (perhaps) because they are, by-and-large, satisfied with the incumbent UDC's service quality.

As suggested by the table, some of the most generous price discounts are being offered by Centrica, better known as British Gas, the former monopoly. Centrica has been incensed when it lost approximately 15 percent of its domestic gas market since the natural gas industry was opened to competition. Many of it customers switched to the public electricity suppliers (PESs) who have entered the gas supply business. Now, Centrica is taking revenge by going after their electricity customers with vengeance. According to early reports, it has thus far acquired over 440,000 electricity customers from PESs.

Competition in the supply business is expected to be fierce, as previously reported. There are dire predictions that the number of PESs will shrink to half as many as there are today over the next few years. This is not a business for the marginal players. Only the best and the biggest will survive.

Opportunities for Private Power Producers in Italy

In his June 9 PowerGen speech, Enzo Gatta, director of the electric energy division of Edison Spa, focused on the opportunities for independent operators in the changing Italian electricity market; he also presented Edison's proposal for adopting the EU directive.

The liberalization of the Italian electricity sector, xxxxxxxxx presents a unique chance for the country, one perhaps never to be repeated. It, therefore, behooves the government, empowered by its parliamentary delegation, to create the most favorable conditions for the development of a truly free and expanded electricity market where operators will be compelled to find new ways to maximize efficiency in production and to use the most advanced technologies.

In such a context, Edison reckons it is easier to achieve the commitments Italy made during the Kyoto conference (the reduction of greenhouse gases by 6.5 percent by 2010 compared to 1990) thanks to the use of technologies such as the gas-fired combined cycle, which permits an increase in energy efficiency and a significant reduction in the emissions of polluting substances into the atmosphere.

Edison believes that recourse to this technology is necessary for Italy, not only to satisfy demand (new plants for an additional capacity of approximately 18,000 MW, necessary to meet the growth in demand from the 273 TWh of 1997 to around 360 TWh in 2010), but also for the revamping and the repowering of less efficient plants, for an estimated capacity of around 12,000 additional/substitutive MW from now to 2010.

That means that a real opening of the market is essential. Taking into consideration this fact, space assigned to the eligible consumers should be, in Edison's view, as broad as possible. The opening up of 25.37 percent of the market may be considered adequate at the outset to introduce competition into the sector. The liberalization of the electricity market, according to the European rules, foresees gradual and progressive but real and concretely verifiable liberalization. For this reason, Edison considers it necessary that the market share to be opened be calculated on the basis of what is the effectively free market and, therefore, net of auto-consumption. As far as the market supplied by the distributors is concerned, there should be a single national rate with no maximum ceiling.

The threshold for eligibility, according to the provisions of the European directive, refers to the consumption size. This definition includes suitable consortiums, the industrial districts, and industrial groups (in accordance with the laws currently in force and in response to the orientation recently expressed by the Industry Ministry). Edison believes that the extension of the concept of "site" to aggregate consumption could contribute effectively to opening the share of liberalized market foreseen in the directive.

One of the main points for the successful functioning of the system, according to Edison, regards the operation of the transmission network and dispatching, which must be neutral and not discriminatory. In order for this to occur, it its necessary that the operation of the network be carried out by an autonomous and independent body. Just as important, in Edison's view, is that the conditions and rates for transmission and auxiliary services be strictly connected to the real costs of the service, and not liable to improper charges.

Edison also considers it necessary to liberalize not only imports and exports but also electricity swaps between those parties which are suitably qualified on the basis of criteria defined in the process of the enactment of the directives.

In conclusion, Gatta stressed that these are the minimum requisites to ensure that the transition to a competitive market comes about in a progressive manner, though with the fastest possible passage from the current regime to final reorganization. That will benefit not only the large industrial groups but also the small and medium size enterprises, which are the backbone of Italy's industrial system.

Edgardo Curcio

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Liberalization of European Energy Markets

*By Horst Michael Hanika**

Editors Note: The GEE hosted a very fine seminar in Berlin in early September on Energy Markets, What's New? *at which Michael Hanika was the dinner speaker. His remarks, though light, are considerably to the point.*

Mr. Chairman, Ladies and Gentlemen

It's in fact only a few hours ago when I heard, that I have to give a dinner speech. Dear Michael, I said to mayself, say something substantial. This is my dilemma: all substantial things have already been said today. It was Winston Churchill, who was asked: "What makes a good speech?" And his answer was: "Well, you must have an attractive introduction, and an encouraging end. And all in between must be very short." That was my introduction, and I come to the center piece, which will indeed be very short.

This is the seventh conference on liberalized energy markets I have attended. And I could have participated in a dozen others, if I had had time. This indicates the degree of uncertainty we all have and the difficulties in drawing a clear picture on what the risks, the challenges and the opportunities are.

In search of solutions, almost everybody came to the same approach: have a look at already existing liberalized markets, thus prognosticating what will be happening here in the developing future energy markets in Europe, especially the biggest market in it, Germany. I congratulate everybody who has a clear picture, who knows what has to be done. However I call to your attention what the German philosopher Eduard Spranger said (this is known as "Sprangers Law") : "The outcome of our doings has always been different from our intentions."

Therefore, my thesis: We do not know what the liberalized energy markets will look like. However, we do know something, we have clear assumptions on the main trends and the main players. But still it appears to me and many others I know, that the future is well structured like a plate of spaghetti. Yes, of course, we have a legal framework, but the rest is market, and market is a chaotic process. This applies certainly to the energy markets, where we envisage rapid and fundamental changes. And let me, therefore, remind you of one important rule of chaos: a minimal change in the starting conditions can reverse the entire process: the butterfly phenomenon.

So, it's very significant, that this conference undertakes to restructure our spaghetti plate. Indeed, this is the first and only conference in which I have been participated, that also deals with corporate strategies and the only one, which has an emphasis on new technologies and renewables.

I'm very grateful for that, because this is exactly the problem, the ABB group has. However, there is a cloven hoof. When we talk about corporate strategies, we think it's the utilities strategies. But they are only a few of many players in this global game, if though the important ones. The utilities will face tough competition by new entrants: utilities from abroad, IPPs, independent marketers, wholesale traders and retailers, aggregators and other service providers. The cake is cut into pieces now, so everbody strives for a share. Fuel suppliers, IT-companies and engineering companies are well aware of their opportunities and not to forget the local municipal distributors, the Stadtwerke, they struggle, in order to survive. All of them have different goals and different strategies.

The possible strategies are numerous:

- One can focus on assets, single assets like power plants, grid, distribution, sales, gas, water, heat or be a multi-supplier.
- One can focus on information, such as traders, service providers, billing companies, stock exchange.
- And one can focus on the end customer, like IPPs and the municipal total service suppliers.

I fear, we still have a plate of spaghetti.

Now, what are the driving forces in this process? There are many, three of them are of paramount importance and you know them well: first it's money – prices, second it's money – cost, and third it's money - profits. Number 12 or so are environmental needs or technical necessities. That explains everything. At this time we still have a distribution system, now we are on the way to a customer market. And this has a number of effects:

- Prices will go down.
- Size becomes an important criterion. The utilities will grow by mergers or acquisitions.
- Electricity is only one form of energy. The customer asks for more. The utilities will diversify, also into fields like water and telecommunication.
- Everybody has to cut costs. Investments will drop, life cycle cost, maintenance, service will be reduced.
- Reserve capacities will be reduced.
- Cost driving power plants will be replaced by cheaper combined cycle gas fired and cogen plants and distributed resources.
- Renewable energies are interesting only in so far as they are competitive, which means for the time being, if they are subsidized – by whomsoever.
- New technical systems, such as distribution automation, dynamic loading, virtual power plants, remote services & repair and online metering will be welcome, under the condition, that they are useful for increasing competitiveness.
- Information technology will play a crucial role, because the amount of information grows by factors of 100. New software will be necessary for power plant control, system operations for grid stability, business management systems for metering, billing and trade.

Well, some people say all this threatening, risky, complex and complicated stuff is terrifying. I would say, it's fascinating. It's a great challenge, but first of all it's a great opportunity. Shouldn't we be grateful that we live in these fascinating times, grateful, that we can be navigators in these troubled waters? Just by having dinner in this marvellous place and talking to one another in a conference like this?

It's a wonderful time and I ask all of you: Let's have an optimistic look on our spaghetti plate.

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* Horst Michale Hanika is Head of the Strategy Department of ABB Germany.

British Institute of Energy Economics

The 1999 BIEE Conference

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

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

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

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

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

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

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

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

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

Outlook for the Italian Energy Market

The following is a brief update on some of the most recent events which have occurred in the Italian energy market.

Electricity

The approach of the of 19 February 1999 deadline set by EC Directive 96/92 ("the Directive"), concerning common rules for the internal market in electricity, is causing a great deal of controversy and concern within the electricity industry.

The preliminary step towards implementation of the Directive was established on 24 April 1998 when Law 128/98 (the so called "Legge Comunitaria") was issued by the Parliament. Article 36 therein sets the general criteria which shall be considered by the Government in order to implement the Directive. The next step which is expected to take place by the end of the current year is represented by the legislative decree which the Government shall approve in compliance with article 36 above and the delegated power contained therein. The guidelines set by the Parliament are the following: a) applying to the market of non-eligible clients a single national tariff and establishing, for the purpose of guaranteeing continuity of production and supply, a single-buyer; b) assigning to the Ministry of Industry, in cooperation with the Ministry for Foreign Trade and with the Public Utilities Authority, the responsibility of safeguarding the safety and economy of the national system, reducing at the same time its vulnerability; c) favoring the aggregation of enterprises, either public or private, operating distribution at the local level; d) incentivating the recourse to renewable sources, also with the purpose of reducing the emission of CO_2; and e) achieving reciprocity vis a vis the other Member States of the European Union, also in order to assure the competitiveness of the Italian electricity industry.

It may be worthwhile underlining that article 36 contains no mention of any kind of future privatization of ENEL, the 100 percent State owned electricity company. This important aspect, which at present seems to have been set aside at the corner of the political arena, shall be tackled by the government soon since many of the key players in the industry, including the Public Utilities Authority ("the Authority"), are convinced that an essential condition to create a really competitive market in electricity is the independence of the manager of the grid.

The role of the Public Utilities Authority, which started to operate in 1997, is becoming increasingly dominant. In particular, the Authority is involved in a comprehensive reform of the existing tariff system which is expected to enter into force by January 1999. It is envisaged that the reform will deal first with tariffs applied for the access to the system by third parties as well as the supply of electricity to distributors (in theory supply prices should be completely liberalized in due course), whereas tariffs concerning generation and transmission are likely to be taken into consideration by the Authority later on.

The Public Utilities Authority also issued on 23 September 1998 its first decision regarding long term supply contracts offered either by ENEL or by a few other major IPPs to big industrial power consumers. It was alleged that ENEL's and the other IPPs' intention was to distort competition by binding in advance future "eligible clients" that, on the liberalization of the electricity industry, will find themselves tied down to the above contracts and unable in practice to take advantage of any more favorable conditions which will be available in the open market. The Authority's decision sets out that all long term supply agreements concluded between eligible clients and ENEL/IPP's as from 30 January 1997 and expiring after 19 February 1999, shall give the clients the right to terminate the contract in advance without any penalty provided that the right is claimed within one year of the acquisition of the qualification of "eligibility".

Another reason for concern with regard to the future implementation of the Directive is given by the share of the market to be liberalized. It is already known that in Italy this share shall be25.37 percent of the market from 19 February 1999. What is so far still unknown is whether this figure is going to include auto production. If auto consumption is excluded, the free market would account for 60 TWh, while to include auto production would reduce such figure to 35 TWh. While ENEL favours the exclusion of auto production IPPs support the contrary opinion. Although article19 of the Directive constitutes an argument in favor of ENEL's position since it includes auto production as one of the criteria for calculating the national market shares, nothing prevents the member state implementing the Directive to accept the opposite interpretation, thus achieving, in fact, a wider liberalization.

While waiting for the new internal regulatory framework to be defined, IPP's have started to get ready by consolidating their activities. Since the Directive foresees a system of thresholds above which a customer becomes eligible, thus acquiring the right to purchase power on the free market, the players are considering all the possible methods to regroup themselves in order to reach the threshold of eligibility. The issue, however, concerns some main aspects which are still not clear such as: a) whether industrial districts will be considered as single, eligible, entities and b) whether an industrial consumer, having several different sites of consumption, will be allowed to add them together, thus claiming eligibility.

Natural Gas

The experience gained in introducing liberalization in the electricity sector is likely to influence the natural gas (NG) market which was shaken by the investigation carried on by the Italian Competition Authority and the subsequent Report published on November 1997.

The Competition Authority highlights that both upstream and downstream are dominated by Eni. Particular stress in put on Eni's gas import and distribution "de facto" monopoly as well as on the vertically integrated structure of Eni in dealing with import, transportation, storage and dispatch activities.

Agip SpA (nowadays a division of Eni) and Snam SpA are considered by the Competition Authority as the main element of distortion within the Italian natural gas market since Agip gas production amounts to 90 percent of the internal production whereas Snam provides 100 percent of the existing storage facilities in addition to dealing with 95 percent of primary distribution activity and one third of secondary distribution.

Snam's above position is deemed by the Competition Authority as incompatible with the other tasks (i.e., transportation, storage and dispatch) carried out by the same entity. It is essential to review Eni's vertically integrated structure

in order to separate import and primary distribution from the other activities of transportation, storage and dispatch. To enhance competition within the market the Ministry of the Treasury is urged to create a new company in charge of NG import and distribution.

Other measures envisaged by the Competition Authority are, inter alia: a) establishment of third parties' right of access to the transportation system for commercial purposes (recognized by the actual legislation only in a very limited number of cases), b) amendment of the current storage licensing regulation (which under Law 170/74 and Decree 625/96 may be granted solely to holders of production licenses) in order to allow undertakings dealing with the downstream industry to enter the distribution sector, and c) introduction of a new tariff regime applicable for the supply of gas to final customers (the Public Utilities Authority started in April 1998 a proceeding which will to lead to the reform of the tariffs system and issued an interim provision aimed at streamlining the mechanism by which tariffs are determined.)

Last but not least, the Competition Authority also started a separate proceeding against Snam which is alleged to have abused its dominant position in so far as it refused to negotiate with Assomineraria (the association representing oil and gas producers) any change as to the prices and conditions applicable to producers for the transportation of gas in the pipelines owned by Snam. It is the Competition Authority's view that Snam's conduct, i.e., refusing to provide transportation services in favor of its customers, may represent an abuse of dominant position. The proceeding is due to be concluded by March 1999.

Oil

A milestone in the recent oil legislation is represented by legislative decree n. 32 of 11 February 1998, on rationalization of the gasoline distribution chain at street level.

In order to meet EU standards, the number of service stations is to be dramatically reduced over a rather short period of time and the surviving stations will be allowed to offer services and goods complementary to the gasoline trade at street level.

The major corporations have already announced their plans of dismissal which will account for some 2,000 stations to be closed in the next two years. However, decree n. 32 does not provide for a numerus clausus of service stations. It will be possible to open new stations: the relevant application must be addressed to the local municipality and silence from the municipality in the following ninety days means approval of the application. Until 31 December 1999, a condition to apply for those applicants which already have service stations in Italy is that they close three or at least two existing service stations (it depends from the total number of gasoline kiloliters sold in the previous calendar year).

If after two years from the enactment of legislative decree n. 32 the total number of service stations existing in Italy is not in line with the average total numbers of Germany, France, the UK and Spain, new reductions will be provided by means of delegated legislation by the Ministry of Industry and Trade.

Edgardo Curcio

Best Paper Award Winners Announced

Vice President for Publications, Hossein Razavi, and former Vice President for Publications, Peter Pearson, have announced the best paper award winners for 1995, 1996 and 1997.

The 1995 and 1996 selection committee, composed of Pearson, Alan MacFadyen, Carol Dahl and Michelle Foss, selected James L. Smith, Professor at Southern Methodist University, as the 1995 award winner for his paper, "On the Cost of Lost Production from Russian Oil Fields from Volume 16, Issue 2 of *The Energy Journal.*

Caroline L. Freund and Christine Wallich were selected the 1996 winners for their joint paper on "The Welfare Effects of Raising Household Energy Prices in Poland", from Volume 17 issue 1 of 1996. Ms. Freund is with the Federal Reserve System in Washington, DC.

There was a tie for the Best Paper of 1997. The committee selected William W. Hogan's paper, "A Market Power Model with Strategic Interaction in Electricity Networks" from Volume 18, issue 4 and the paper, "CO_2 Emission Limits: Economic Adjustments and the Distribution of Burdens" by Henry Jacoby, Richard Eckaus, Denny Ellerman, Ronald Prinn, David Reiner and Zili Yang from Volume 18, Issue 3. In addition to Razavi, the 1997 committee was composed of Denis Babusiaux, Kenichi Matsui, Robert Pindyck, and John Weyant.

Each year the IAEE presents a Best Paper Award to the author of the paper deemed to be the best in *The Energy Journal* of that year. The award has been made annually since 1989.

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

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

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

Publication is planned for early in 1999.

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Energy Risk Management, Peter C. Fusaro (1998). Price: $70.00 in North America or £ 53.99 in Europe. Order Number 0-7863-1183-3. McGraw Hill Publishing, PO Box 182604, Columbus, OH 43272-3031. Phone: 1-800-2-MCGRAW or Fax: 1-614-759-3644 in the US, and Phone: 44-1628-502-532, or Fax: 44-1628-621-662 in Europe.

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Gas Liberalisation in Europe (1998). Price: £399. Contact: Management Reports, ICBI, 8th Floor, 29 Bressenden, Place London SW1E 5DR, United Kingdom. Phone: 44-171-850-5103. Fax: 44-171-850-5101.

The Future of the European Electricity Market (1998). Price: £399. Contact: Management Reports, ICBI, 8th Floor, 29 Bressenden, Place London SW1E 5DR, United Kingdom. Phone: 44-171-850-5103. Fax: 44-171-850-5101.

Calendar

7-8 November 1998, Caspian Oil & Gas Resources: Transport Routes, Security & Economic Development. Tehran, Iran. Contact: Conference Secretariat, PO Box 19395, 4757 Tehran, Iran. Phone: 009821-2221793/95. Fax: 2221798.

9-11 November 1998, PQA '98 Southern Hemisphere: Power Quality in a Competitive Environment. Cape Town, South Africa. Contact: Marsha Grossman, EPRI, 3412 Hillview Avenue, Palo Alton, CA 94304. Phone: 650-855-2899. Fax: 650-855-8576. E-mail: mgrossma@epri.com

10-11 November 1998, OGP, Korea. Sheraton Walker Hill, Seoul, Korea. Contact: Ms. Jolene Pee, Event Coordinator, 80 Marine Parade Road, #13-02 Parkway Parade, Singapore, 449269. Phone: 65-345-7322. Fax: 65-345-5928. E-mail: jolene@cmtsp.com.sg

11-14 November 1998, Wholesale Power in the West. Las Vegas, Nevada, USA. Contact: IBC USA Conferences, 225 Turnpike Road, Southborough, MA 01772-1749. Phone: 508-481-6400. Fax: 508-481-7911. E-mail: reg@ibcusa.com

11-14 November 1998, EP China '98, 7th International Exhibition on Energy & Power. Beijing, PR China. Contact: Adsale Exhibition Services Ltd., 4/F Stanhope House, 734 King's Road, North Point, Hong Kong. Phone: 852-2811-8897. Fax: 852-2516-5024. E-mail: aes@adsaleexh.com

12-13 November 1998, 2nd Annual Global Gas '98. Rome, Italy. Contact: Global Pacific & Partners, Ltd., No. 8 Victory Road, Greenside 2021, Johannesburg, South Africa. Phone: 27-11-782-3189. Fax: 37-11-782-3188. E-mail: global.pacific@pixie.co.za

16-17 November 1998, Asia Power. Manila, The Philippines. Contact: Ms. Jolene Pee, Event Coordinator, 80 Marine Parade Road, #13-02 Parkway Parade, Singapore, 449269. Phone: 65-345-7322. Fax: 65-345-5928. E-mail: jolene@cmtsp.com.sg

18-20 November 1998, Generating Power in India. Taj Palace Convention Centre, New Delhi, India. Contact: Mr. Benny Carvalho, IBC Global Conferences Ltd., 2 & 3 Vasant Apartments, Vasant Villa, New Delhi, 110057, India. Phone: 009111-6141037. Fax: 009111-6140818.

19-21 November 1998, 7th International Energy Conference and Exhibition - ENERGEX '98, Manama, Bahrain. Contact: Dr. W.E. Alnaser, Conference Secretariat, Dean, Scientific Research, University of Bahrain, PO Box 32038, Bahrain. Phone: 973-688381. Fax: 973-688396. E-mail: EA607@isa.cc.uob.bh

2-4 December 1998, Successful Load Profiling: How to Make Retail Access Work for Distribution Companies, Suppliers and Customers. Grand Hyatt, San Francisco, CA. Contact: IBC USA Conferences, Inc., 225 Turnpike Road, Southborough, MA 01772-1749. Phone: 508-481-6400. Fax: 508-481-7911. E-mail: reg@ibcusa.com

2-4 December 1998, Indian Oil and Gas Conference. Taj Palace Hotel, Contact: IOGC '98 Secretariat, 212A Telok Ayer Street, Singapore 068645. Phone: 65-226-5280. Fax: 65-226-4117.

3-4 December 1998, Private Energy in Turkey. Washington, DC, USA. Contact: Registration Dept. The Center for Business Intelligence, LLC, 500 W Cummings Park, Ste. 5100, Woburn, MA 01801. Phone: 781-939-2438. Fax: 781-939-2490. E-mail: registrar@cbinet.com

8-9 December 1998, Business & Investment Strategies for Oil & Gas Exploration & Production. Hotel Okura, Amsterdam. Contact: Upstream Conference Administrator, ICBI, 8th Floor, 29 Bressenden Place, London SW1E 5DR, United Kingdom. Phone: 44-171-915-5103. Fax: 44-171-915-5101.

10-11 December 1998, Contracting for Power. Shanghai Hilton, Shanghai, PRC. Contact: IBC Asia Limited, No. 1 Grange Road, #08-02 Orchard Bldg., Singapore 239693. Phone: 65-732-1970. Fax: 65-733-5087.

9-11 December 1998, Power-Gen '98. Orlando, Florida. Phone: 918-831-9160.

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

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

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11-22 January 1999, 5th International Training Program on Utility Regulation and Strategy. Gainesville, Florida. Contact: Pascale Parker, Program Manager, PURC, 205 Matherly Hall, University of Florida, Gainesville, FL 32611. Phone: 352-392-6148. Fax: 352-392-7796. E-mail: purcecon@dale.cba.ufl.edu URL: http://www.cba.ufl.edu/eco/purc/

26-27 January 1999, European Electricity Trading: Strategies for a Deregulated Europe. Central London, UK. Contact: Oliver Brady, ICM Conferences, 4 Cavendish Square, London W1M 0BX, UK. Phone: 44-171-499-0900. Fax: 44-171-580-2071. E-mail: oliverb@thguk.com

3-5 February 1999, PowerFair '99. Houston, Texas, USA. Contact: Enerdata Ltd. Phone: 905-470-0117. Fax: 905-479-2515. E-mail: enerdata@inforamp.net

14-18 February 1999, DistribuTECH '99. San Diego, CA. Contact: Nancy Wilson, Conference Manager, PennWell Conferences & Exhibitors, 1421 S. Sheridan Road, Tulsa, OK 74112-6600. Phone: 918-831-9438. Fax: 918-831-9834. e-mail: nancyw@pennwell.com

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

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

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

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

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

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

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

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

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

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