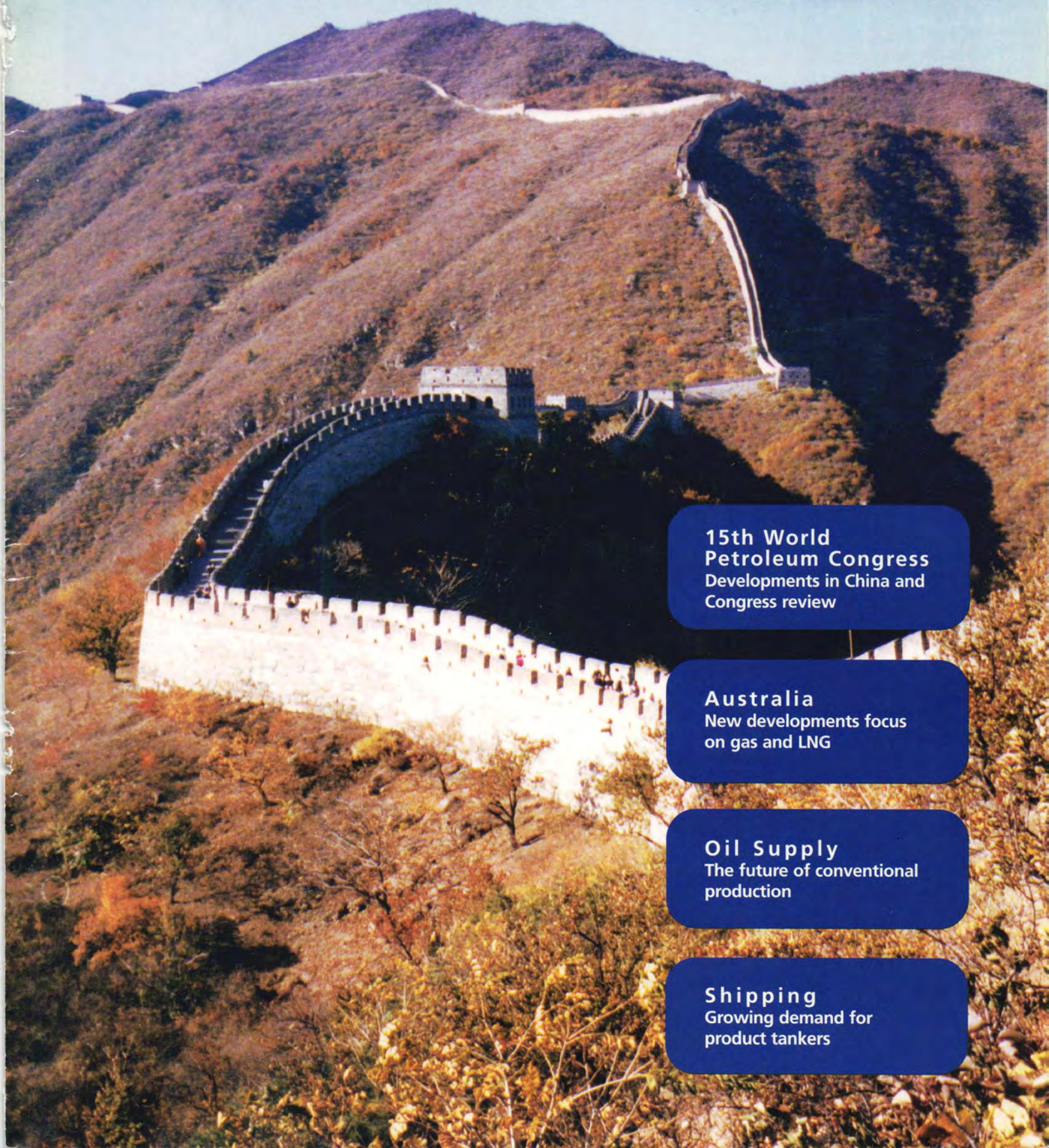
PETROLEUM REVIEW

THE INSTITUTE OF PETROLEUM

DECEMBER 1997



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PETROLEUM REVIEW

DECEMBER 1997 VOLUME 51 NUMBER 611
£8.00 • SUBSCRIPTIONS (INLAND) £95.00 (OVERSEAS) £110.00

PUBLISHER

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A charitable company limited by guarantee
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SUBSCRIPTIONS

Subscription Enquiries: Portland Press
Tel: +44 (0)1206 796351 Fax: +44 (0)1206 799331

Printed by The Thanet Press Ltd, Margate

US MAIL: *Petroleum Review* (ISSN 0020-3076 USPS 006997) is published monthly by the Institute of Petroleum and is available Periodical Postage Paid at Middlesex, New Jersey.
Postmaster: send address changes to *Petroleum Review* c/o PO Box 177, Middlesex, New Jersey 08846, USA.

ABC BUSINESS PRESS
ISSN 0020-3076
MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

ABBREVIATIONS

The following are used throughout *Petroleum Review*:

mn	= million (10^6)	kW	= kilowatts (10^3)
bn	= billion (10^9)	MW	= megawatts (10^6)
tn	= trillion (10^{12})	GW	= gigawatts (10^9)
cf	= cubic feet	kWh	= kilowatt hour
cm	= cubic metres	km	= kilometre
boe	= barrels of oil equivalent	sq km	= square kilometres
		b/d	= barrels/day
t/y	= tonnes/year	t/d	= tonnes/day

No single letter abbreviations are used. Abbreviations go together eg. 100mn cf/y = 100 million cubic feet per year.

Front Cover: The Great Wall of China. All China pictures in this issue by C. Skrebowski.

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China becomes key player

The recent 15th World Petroleum Congress in Beijing confirmed beyond doubt that China has become a key player in the international oil and gas industry (p550). Since 1977, the opening up of the Chinese offshore, and since 1986 the onshore, has provided a number of opportunities for the major international oil and gas companies. To date most have seized the opportunity and have greater or lesser interests in China.

China's greatest impact on the international industry will, however, be its expanding energy demand. As Wang Tao, for 11 years President of China National Petroleum Corporation (CNPC), explains (p552) China expects to be consuming 5.2mn b/d of oil and 5.8bn to 7.7bn cf/d of gas by 2010.

Despite the country's considerable success in finding new resources and maintaining production from existing fields most of the incremental demand will have to be met by imports.

China recently signed contracts with Kazakhstan to develop oil and gas fields and to build a pipeline to China, indicating just how seriously the country is taking the problem of future energy supplies. The warming of relations with the Russians and the recently announced plans for gas pipelines from eastern and possibly western Siberia shows that the Russians are about to open up major new hydrocarbon supply routes to the Far East and have secured a notable customer in China.

The casual and somewhat complacent assumption that the Europeans can buy as much Russian gas as they want and that oil and gas production from the southern republics of the former Soviet Union will be freely available to western buyers may now have to be revised.

China's potential demand is so great that developing Russian and Caspian resources can no longer be seen as an alternative to increased dependence on the Middle East supplies in other than the short term.

First oil from Azerbaijan's four-billion-barrel offshore Chirag, Azeri and deepwater Guneshli field complex is currently completing its pipeline journey to the Russia Black Sea loading port at Novorossiysk, a notable achievement by the BP-led consortium developing the fields. By 2007 it is anticipated that production will have built up to over 700,000 b/d.

The industry's problem, however, is that despite the large new projects, the world is currently consuming 74.5mn b/d and demand is rising at the rate of 2mn to 2.5mn b/d, or roughly the total current output of the UK North Sea every year.

Some industry experts are already beginning to question whether the reserve base can support likely oil demand in the decades ahead. We report on a conference held this summer to consider the problem (p559).

The latest conference on climate change is to be held in Kyoto in December. Great hopes have been raised in some quarters for a binding agreement on reductions in carbon dioxide emissions by the developed nations. To much approbrium from environmentalists and so-called climate experts Exxon's Chairman gave a speech in Beijing that questioned both the science and the logic of emission targets and drew attention to the costs so casually ignored by the environmental zealots.

Clearly there is much positioning and lobbying going on and equally clearly any agreement will involve hard trade-offs or much fudge. A cynic might observe that the last, albeit voluntary, emission reduction targets agreed at Rio were only achieved by the UK and Germany. The former by closing down the UK coal industry, the latter by closing down East Germany's lignite burning industry.

Chris Skrebowski

Floating first for Indian oilfield

A consortium led by Hardy Oil & Gas has commenced oil production from the PY-3 field located in water depths of 80 to 250 metres in block CY-OS-90/1 in the Cauvery Basin, offshore India.

The PY-3 field is the first marginal field discovery to produce oil offshore Tamil Nadu and the first in India to be developed using a semi-submersible floating production system. Four wells (two new wells and two well re-entries) are currently producing around 13,000 b/d of sweet 48° API oil. Output is being sold to Madras Refineries – the first 400,000 barrel cargo was delivered to the company on 10 October.

Field participants are Oil & Natural Gas Corporation (ONGC) which holds a 40% stake, Hindustan Oil Exploration 21%, Tata Petrodyne 21% and Hardy Exploration & Production (India) 18%, which acts as operator.

In Brief

BHP Petroleum and Sonatrach have *announced the third successful well of the current drilling programme on blocks 401a/402a in southern Algeria. The Bir Sif Fatima North-2 (BSFN-2) located in block 402a in the Ghadames Basin in central-eastern Algeria tested at 6,018 b/d.*

It has been reported that Cameroon *plans to grant four oil companies exploration permits for nine shallow water blocks in the Douala Kribi Campo Basin which lies southeast of the Isongo oilfield.*

Bow Valley Petroleum is to purchase a *13.75% working interest in North Sea block 22/2a, which contains the Chestnut field, from BG Exploration and Production. Financial terms of the deal have not been disclosed.*

Shell, Agip, British Gas, British *Petroleum, Mobil, Statoil, Total and KazakhstanCaspishelf have signed a production sharing agreement (PSA) with the Republic of Kazakhstan for permits in the North Caspian Sea. Several exploration wells are to be drilled under the terms of the PSA, the first of which is planned in spring 1998, and a limited amount of additional seismic data acquired. The acreage covers approximately 6,000 sq km of the North Caspian.*

Chevron has approved a project that *will nearly double the capacity of its newly commissioned Escravos associated-gas utilization project in Nigeria. The $550mn project has a daily production of some 130mn cf of dry gas, more than 8,000 barrels of LPG and natural gas liquids and 2,000 barrels of condensate. It exported its first cargo of LPG in September 1997. The newly approved second phase, which will add a further 110mn cf of gas and 6,700 b/d of liquids per day, is due onstream in late 1999.*

Enterprise Oil's Chief Executive Pierre *Jungels has said that delays in new production, together with a number of technical problems at mature fields, mean that the company will not meet its production target of 320,000 boe/d in 1999. Instead, production is expected to reach about 290,000 boe/d in 1999, with output not reaching 320,000 boe/d until 2000.*

Italian oil company Agip has acquired *a 50% interest, and assumed operatorship, of the M'polo, Chaillu Marin and Meboun Marin oil licences in Gabon from Occidental Petroleum.*

NEWS Upstream

Hibernia onstream ahead of schedule

The 750mn-barrel Hibernia oilfield on Newfoundland's Grand Banks has come onstream a month ahead of schedule. The project's first well is producing at 20,000 b/d. A second well, producing at a similar rate, will be completed this month.

The field is being developed by a fixed production platform comprising a concrete gravity base structure (GBS) and topsides drilling and production facilities. The GBS has a storage capacity of 1.3mn barrels of oil which will be transferred to tankers via an offshore loading system. The GBS is the first of its kind to be designed to withstand the impact of the sea ice and icebergs which occasionally transit the Grand Banks region.

Production is expected to peak at 180,000 b/d in 1999. However, this was originally forecast to be 135,000 b/d and the platform, which currently has a capacity of 150,000 b/d, will require slight modification to achieve the higher target. Field life is estimated to be 18 years.

Partners in Hibernia are: Petro-Canada 20%, Mobil 33.125%, Chevron 26.875%, Murphy 6.5%, Canada Hibernia Holding Corporation 8.5% and Norsk Hydro 5%.

Australian marine park gets oil industry support

A new multiple-use marine park is planned to be established off the coast of south Australia. Much of the proposed benthic protection zone covers an area considered to have medium to high prospectivity for oil or gas. There are currently no petroleum permits within the proposed park boundary. However, the Notice of Intent issued does not unilaterally preclude exploration and development, and signals a recognition by the federal government of the potential of this region to generate additional wealth for Australia.

Crine crackdown on North Sea drilling operations

Crine Network is to undertake a survey of companies involved in drilling, operating and maintaining oil and gas wells in the North Sea in a bid to identify best practices and wasteful practices in the industry. The organization says that it plans to double the value industry gets from its wells by the year 2000 by 'eliminating waste and promoting efficient and effective work methods'. Questionnaires will be sent to managing directors, engineers and roustabouts from over 150 companies. A donation of £5 will be made to Children in Need for each returned questionnaire.

Feedback from the survey will be reported to the industry at the Crine Network Conference which is to be held in London on 24 and 25 February 1998.

Erskine onstream

The Texaco-operated Erskine gas condensate field in the North Sea has produced first gas. Initial production is to be followed by further development drilling before peak production of 120mn cf/d of gas and 29,600 b/d of condensate is reached from the field's six producer wells in October 1998. Recoverable reserves are estimated at more than 333bn cf of natural gas and over 75mn barrels of condensate.

Straddling blocks 23/26b and 23/26a, the £290mn project has been developed as a 50:50 joint venture between BP and Texaco. The high pressure/high temperature field lies at a depth of 15,000 feet with a bottom-hole pressure of 14,000 psi and a temperature of 340°F.

Produced gas and liquids are piped, unprocessed, via a 16-inch multiphase pipeline to Amoco's Lomond platform for separation and export. Liquids are exported via BP's Forties pipeline system to Crude Bay, Scotland. Gas is transported through the Amoco-operated CATS pipeline to Teesside where it is processed to sales quality at the Amoco-operated terminal.

Norwegian field delays

New Norwegian gas developments are said to be unlikely to get the go-ahead before 1999 following recommendations from the Gas Supply Committee (FU) that the next gas allocation round be postponed from February until September 1998 as current and developing fields are capable of meeting existing requirements.

The FU advises the Norwegian Ministry of Petroleum and Energy which offshore fields should deliver gas under contracts negotiated by the Gas Negotiating Committee. At present, spare capacity in the Sleipner and Troll fields is used to meet part of existing gas supply contracts with European buyers. Some 450bn to 500bn cm of gas deliveries have yet to be allocated to supply fields. Oseberg, the Gullfaks satellites, Huldra and some fields offshore mid-Norway are expected to meet some of this demand from 2000.

It is proposed that recommendations for new supply fields go to the Ministry in December 1998, which would then decide on new developments in the first half of 1999. These would probably start in 2002.

In Brief

BG plc is to sell its German assets to *Leipzig-based gas transmission company Verbundnetz Gas. The assets comprise the holding company British Gas Deutschland which has a 5% shareholding in Verbundnetz Gas; a 25% stake in gas transmission and distribution company Gasversorgung Sachsen-Anhalt which serves the Halle region, and a 25.5% interest in Erdgas West-Sachsen, a regional transmission and distribution company.*

BP Shipping has concluded an agree- *ment to bare-boat charter four new double hulled very large crude carriers (VLCCs) which will be delivered in 1999 and 2000. The vessels will be built by Samsung Heavy Industries and will be chartered by BP from Cambridge Oil Transportation Corporation.*

Conoco is to acquire Amoco's 33.3% *interest in block 206/9 Area A which includes a 4.34% interest in the Clair field west of Shetland. The deal increases Conoco's share in Clair to 20.73%.*

BP's Troika oil and gas field in Green *Canyon block 200 in the Gulf of Mexico has come onstream. Some 6,500 boe/d is initially flowing from the field's first five planned wells, a figure forecast to rise to 30,000 boe/d or more once the wells enter full production. The overall project will reach a peak production of 80,000 b/d of oil and 140mn cf/d of gas in 1998.*

It has been reported that the Export- *Import Bank of Japan is to provide some $100mn in loans for the development of the Sakhalin II oil and gas project which is expected to begin well testing in July 1998. First gas is scheduled for 2005. The European Bank for Reconstruction and Development and the US are also expected to provide two further $100mn loans for the project.*

Mexico's Energy Ministry has reported *that in excess of $3.4bn is to be invested in contracted energy projects in the country in 1998. Almost 40% of the funds will be invested in boosting output from Canterell, Mexico's largest offshore oilfield, located in the Campeche Sound.*

China has revised its gas reserve fig- *ures for the Qaidam Basin in the western Qinghai province. The basin is now reported to hold 150bn cm of proven gas reserves, making it the fourth largest deposit in the country.*

NEWS Upstream

BG/Arco collaboration in Indonesia

Subsidiaries of BG plc and Arco have announced an agreement to collaborate in the supply of gas to the proposed Tangguh liquefied gas (LNG) project in Irian Jaya, eastern Indonesia, using reserves from the Wiriagar, Berau and Muturi production sharing contracts (PSCs).

Operational responsibility for the fields within the three blocks feeding the Tangguh project will belong to Arco, which has been designated the PSC representative to state oil company Pertamina.

Partners in the Berau block are: Arco, 48% Occidental, 22.856%; Nippon Oil, 17.144%; and KG Berau Petroleum, 12%. Partners in the Wiriagar block are: Arco, 80%; and KG Wiriagar Petroleum, 20%. Arco acts as operator of both blocks. BG Exploration and Production holds a 50% interest in the Muturi concession and acts as operator. Other participants are: Cairns Ltd, 45% and PT Saptapetra Wisesa, 5%.

BG and Arco also announced that the Vorwata-4 well located on the leaseline between the Arco-operated Berau block and the BG-operated Muturi block has flowed gas at a rate of 36mn cf/d. Arco states that the well indicates that the Vorwata reservoir extends northward into the Muturi PSC, providing the area with additional reserve potential beyond earlier estimates and giving further support to a multi-train Tangguh LNG project.

To confirm and delineate the extension of the Vorwata reservoir into the Muturi block, BG and its partners plan a continuous programme of drilling in Muturi through to mid-1998.

Horizontal well record for Wytch Farm

BP Exploration and its partners in the Wytch Farm oilfield on- and offshore Dorset has established a new record horizontal departure with its M11 well. Extending some 8,388 metres, M11 beats a well drilled by Phillips in China earlier this year which had a departure of 8,061 metres. According to BP, its ultimate target is to reach a final horizontal departure of 10 km.

The success of the M11 well is attributed to the ability to drill over 7,400 metres of 'open hole' before casing. The well is scheduled to complete by January 1998 and is expected to recover oil reserves of between 3 to 8mn barrels.

Russian move for BP

BP has announced that it intends to purchase a 10% equity interest in Sidanco, Russia's fourth largest integrated oil company. The purchase will be made from Unexim Bank, Sidanco's majority owner, for $571mn.

BP will additionally acquire 45% of Sidanco's 60% interest in Rusia, an Irkutsk-based company with major oil and gas discoveries in East Siberia. In return for this interest, BP will meet $172mn of the future costs of the appraisal programme for the Rusia discoveries. These include the Kovyktinskoye gas condensate field which has estimated gas reserves of at least 25tn cf and is earmarked to supply the growing markets of China and the Far East.

BP reports record third-quarter profits

British Petroleum has reported record third-quarter and nine-month earnings. Third-quarter replacement cost profit before exceptional items rose to $1.13mn, up 11% from the third quarter of 1996. For the first nine months of 1997, replacement cost profit before exceptional items was $3.56bn, up 18% on that recorded in the same period a year earlier.

BP Chief Executive John Browne attributed the improved results to the company's 'self-help' efforts and increased volumes of downstream sales. He also stated that underlying performance improvements for the first nine months of 1997 were $450mn, $150mn above the $300mn target set for the year as a whole.

Exploration and Production recorded a drop of $87mn in third-quarter replacement cost operating profit to $1.10mn compared to the same period a year earlier. The decrease reflected a $2 per barrel drop in the price of oil. Volumes were up however – oil production increased by just 1% while gas production rose by some 11%.

Continuing improvements in refining, marketing and trading performance, together with volume increases and the efficiencies created by the BP/Mobil European joint venture, were said to have contributed to the 82% improvement in third-quarter operating profit to $432mn recorded in the Refining and Marketing division.

The Chemical's result was up by 10% in dollar terms over a year ago, the effect of significantly higher volumes partly offset by the strength of sterling and a weaker Deutschmark, said BP.

In Brief

BG Exploration and Production, *Shell and Edison International have signed a gas sales agreement with the Egyptian General Petroleum Company to supply some 250mn cf/d of gas from the Rosetta concession offshore the Nile Delta in Egypt. Gas deliveries will commence in January 2000.*

Kvaerner Oil & Gas has secured a *$29mn contract from Bentec Norge for the fabrication of drilling facilities for Esso Norge's Jotun field development. Construction will be carried out at Kvaerner's Port Clarence yard at Middlesbrough, Teesside. Sailaway is scheduled for August 1998.*

Spanish companies Repsol and *Iberdrola have signed an agreement to create a joint venture company by the end of January 1998 that will be responsible for a number of new energy projects planned for the country. Each will hold a 50% stake in the new venture.*

Lord Fraser of Carmylie has been *appointed non-executive Chairman of JKX Oil & Gas, replacing Sir Robert Horton who resigned last month.*

The Senate of Romania has approved *the creation of a new oil company – Societatea Nationala a Petrolui Petrom (SNP) – that will replace Romania's national oil company CRP.*

Unocal is reported to have signed *a letter of intent with Vastar Resources under which it will take a 25% working interest in Vastar's deepwater Mirage project in Mississippi Canyon block 941. In turn, Vastar will acquire Unocal's working interests in several Oklahoma and Texas fields.*

Yemen is reported to have signed a *$15mn deal with First Calgary Petroleum of Canada covering two phases of oil exploration in the southern province of Hadramaut.*

Arco British reports that it *has received partner approval for the development of the Bure West and Deben gas fields in the southern sector of the North Sea. It is proposed that the fields be developed as subsea tiebacks to a new platform that is being constructed by SLP for the Thames complex. Development is subject to UK Department of Trade and Industry approval.*

NEWS Upstream

Gas sales agreed for Egyptian field

Amoco Egypt Ras El Barr has announced the signing of a gas sales agreement for the Ha'py field located in the offshore Ras El Barr concession in Egypt's Nile Delta.

Amoco and its partners IEOC Production and the Egyptian General Petroleum Corporation will produce 8mn cm/d of gas beginning in late 1999. The gas will be sold to the Egyptian domestic market.

The field is being developed by an unmanned, remotely controlled platform located in 80 metres of water. Initially five wells will be produced with the drilling of additional production wells dependent upon reservoir behaviour. Production will be delivered to shore via an 81-km multiphase pipeline. A new onshore gas processing plant located 20 km west of Port Said on the Mediterranean coast is to be constructed over the next 24 months.

Total investment for field development and the construction of the associated gas processing facilities is put at $248mn.

First oil from Chirag

First oil has been produced from the AIOC-operated Chirag field in Azerbaijan. The oil is being carried via a 1,000-km pipeline linking Baku to the Russian Black Sea port of Novorossiysk via Chechnya.

The Chirag field is one of three in the region being developed by AIOC. Together, the three fields are estimated to hold some 650mn tonnes of recoverable reserves.

A second pipeline linking Baku to the Georgian port of Supsa is currently being refurbished. It will carry AIOC crude by the end of 1998.

AIOC is a BP-led consortium comprising Norway's Statoil (8.56%); US companies Amoco (17.01%), Exxon (8%), Unocal (10.05%) and Pennzoil (4.82%); UK company Ramco (2.08%); Russia's Lukoil (10%); TPAO of Turkey (6.75%); Saudi Arabia's Delta Nimir (1.68%); and Itochu of Japan (3.92%). BP holds a 17.13% share in AIOC, and Azeri state oil company SOCAR holds 10%.

African redevelopment option for Ranger

Ranger Oil has joined a production sharing contract and assumed operatorship of block CI-26, which includes the Espoir field, offshore Cote d'Ivoire, West Africa.

The Espoir field contains remaining recoverable reserves of approximately 70mn barrels of oil and 200bn cf of gas. Prior to abandonment in 1988, the field produced 31mn barrels of oil at rates of up to 20,000 b/d by natural depletion.

Ranger and its partners plan to use the latest drilling and production technology to redevelop the field. First production is expected as early as 2000 at approximately 20,000 to 25,000 b/d of oil.

Total field development costs are expected to be about $250mn.

Participants in block CI-26 are: Ranger Oil Cote d'Ivoire 24%, Addax Petroleum Cote d'Ivoire 42% (previous operator), Tullow Cote d'Ivoire 24% and Petroci 10%.

Lasmo outlines exploration success

Speaking at an energy conference held in New York last month, Lasmo's Chief Executive Officer Joe Darby reported that new discoveries in the UK, Algeria, Libya and Pakistan, together with the reserves in the Dacion area in Venezuela, have the potential to add further commercial reserves of 800mn boe. This compares with the 729mn barrels booked at the end of 1996.

These fields will be subject to further appraisal which should result in their reserves being booked over the next three to four years, ensuring a high reserve replacement rate during that period.

Based on worldwide exploration and appraisal activity in 1997 to date, Lasmo expects to report at the year end reserve replacement of about 150% at a cost of around $1.50 per barrel. This excludes reserve additions from Venezuela which the company has already indicated will be over 175mn barrels of oil on a US securities and exchange commission (SEC) proved basis.

The company also reported that it expects its acreage portfolio and exploration programme over the next five years to deliver, on a risked basis, in excess of an additional 400mn boe. Lasmo states that it aims to raise production from the forecast of 250,000 boe/d in 2001 to over 300,000 boe/d by 2005.

In Brief

Enterprise Oil and Texaco are reported *to have sold their 20% interests in a gas exploration concession in the Bulgarian sector of the Black Sea to Petreko Petroleum Company.*

Basin Exploration of the US is reported *to have acquired assets in four of Midcon Offshore's offshore oil and gas operations – including a 33% working interest in High Island block A-568, a 52% working interest in Vermilion blocks 329/338 and 100% working interests in both East Cameron block 220 and West Cameron blocks 45/56 – for some $31.3mn.*

OMV has strengthened its position in *Pakistan with the signing of exploration licenses for two additional areas in the south of the country. The 2,415 sq km Shah Bandar block is located primarily onshore while the 3,770 sq km Indus Delta block lies mainly offshore.*

Gabon is reported to have signed four *new oil licence agreements with Amerada Hess. The agreements cover the offshore Azobe, Ozigo and Bilinga blocks and the Apari block near Port Gentil. Perenco and Energy Africa are also reported to have signed an exploration and production sharing agreement for Nziembou-Digheghi in Ngounie province.*

The Russian Government is reported to *have lifted its 15% restriction on the foreign ownership of Russian oil companies in a bid to encourage foreign investment in the next round of privatizations. Plans have already been announced to sell a 19% stake in Slavneft by the end of 1997. Some 15% of Lukoil is also to be offered in an investment tender in the near future.*

The future of the Philippines' oil *industry is reported to be uncertain following an announcement from the Philippine Supreme Court that the law deregulating the country's oil sector, passed earlier this year, is 'unconstitutional'. The announcement threatens new investment plans which may be put on hold until the situation is resolved.*

Chevron's deepwater development *programme in the Gulf of Mexico is aiming to add more than 2bn barrels in new oil reserves over the next 10 to 20 years, according to Peter Robertson, President of Chevron USA Production Company. The company currently holds 362 deepwater leases in the region and has three deepwater drilling rigs under long-term contract.*

NEWS Upstream

Shell signs strategic Russian alliance

Shell has formed a strategic alliance with Russian oil and gas companies Gazprom and Lukoil under which the three companies will cooperate on a wide range of oil, gas liquids and natural gas development projects in both Russia and internationally. It is intended that the newly created joint development company will produce around 25mn tonnes a year of oil and gas condensates (approximately 500,000 b/d).

The first joint project of the alliance will be the development of the Zapolyarnoye oil and gas field in Western Siberia. Liquids and gas production is scheduled to commence in 2003. International projects are expected to include a gas/oil transportation project in Turkey and the development of the Asian gas market.

As part of the alliance, Shell has, subject to certain conditions, committed to invest up to $1bn in a convertible bond to be issued by Gazprom. This bond purchase will be carried out simultaneously with a public offering by Gazprom of up to $1bn to institutional investors under identical terms. This is expected to take place in early 1998.

The three companies have also signed a Memorandum of Understanding under which they will jointly bid for Rosneft privatization tenders. It is expected that the sale of shares will be announced before the end of 1997 and completed by mid-1998.

Latest UK offshore accident figures

The UK Health and Safety Executive's (HSE) latest offshore statistics report, which includes provisional accident and incident figures for the year 1 April 1996 to 31 March 1997, indicates a long-term improvement in accident rates offshore compared to levels experienced prior to 1992.

The report is the first since the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR) brought reporting arrangements offshore into line with the onshore regime in April 1996. Some caution is required, the report notes, as the new RIDDOR regime introduces changes to the definitions of 'dangerous occurrences', though reportable injury categories have not been greatly affected.

Two fatalities, 25 serious injuries, 328 'over three-day' injuries and 585 dangerous occurrences were reported in 1996/97 compared with five fatalities, 43 serious injuries, 374 over three-day injuries and 528 dangerous occurrences in 1995/96 (final figures).

For consistency with other HSE injury statistics, data is also presented in the form of incidence rates per 100,000 employees which HSE considers to provide a better basis for comparison and trend analysis. The rates indicate that there has been a substantial reduction in major injury rates and some improvement in the over three-day injury rate which, the report notes, increased in 1995/96, but decreased again in 1996/97. Overall, fatalities, major and over three-day injuries are being reported at a lower rate than prior to 1992.

Approximately 35% of injuries were associated with slips, trips and falls and 22% due to handling goods or materials; 29% of injuries involved drilling/workover operations. Fingers and backs were the most common injury sites (24% and 14% respectively). No obvious pattern of occurrence during the year was recorded.

Shell outlines 1997 performance to date

Shell has reported a 5% rise in third quarter results for 1997 with earnings of £1,173mn on a current cost of supplies (CCS) basis excluding special items. Reported net income was £1,268mn, some 5% less than last year. For the first nine months of 1997, earnings on an estimated CCS basis (excluding special items) were a record for the second successive year at £3,939mn.

According to Shell, cost reductions maintained earnings in the 3Q1997 for exploration and production at the 1996 level of £595mn in spite of a drop in oil prices. Crude oil production outside the US was 1.8mn b/d, 4% lower than last year, with increases in Venezuela and Syria more than offset by declines mainly in the UK and Malaysia. Natural gas sales were down by 6% with increases in the UK and Norway not fully compensating declines in Malaysia and the Netherlands. Crude oil production in the US was up 12% from new production in the Gulf of Mexico.

Improved performance in Europe led to a 7% increase in refining and marketing earnings on a CCS basis to £451mn. There were inventory holding gains of £57mn in the 3Q1997 compared with gains of £128mn in the same period last year. This led to an 11% drop in reported earnings.

In chemicals, improvements in Europe and the Asia-Pacific were outweighed by lower results in the US where overcapacity is an increasing problem. Third quarter earnings on a CCS basis closed at £167mn, down 12% on 1996's figure.

In Brief

***Amerada Hess, Shell and Texaco have** announced plans for the joint development of the Bittern and Guillemot West fields in the central North Sea. Subject to approval by the UK Government, the fields will be developed by a floating production, storage and offloading facility. Gas will be exported via the Fulmar gas pipeline.*

***The Turkmenistan Government is** reported to have excluded three oil and gas fields – Lachin, Yelbars and Burgut – from the 11 areas originally offered in its first round of international tendering for oil and gas exploration and production in the Turkmenistan shelf of the Caspian Sea. The three areas, which lie along the Turkmen–Iranian border, will now be jointly developed by Turkmenistan and Iran.*

***The Azerbaijan Government is** reported to have ratified an agreement on the joint development of the D-22 Yalama oil block by Russia's Lukoil and the State Oil Company of Azerbaijan. The discovery lies on the border of the Azerbaijan and Russian Caspian sectors.*

***Triton Energy is reported to have** found an eighth natural gas field in the Gulf of Thailand with its Wira 1 exploration well. Located on the central part of the Malaysia-Thailand Joint Development Area (JDA), the well flowed at 9.1mn cf/d of gas and 137 b/d of condensate.*

***Consolidated Natural Gas of the US is** reported to have made two gas discoveries in the shallow waters of the shelf of the Gulf of Mexico. The Nautilus and Nemo discoveries lie in the Main Pass area off the mouth of the Mississippi river.*

***Myanmar Oil and Gas Enterprise and** Texaco Exploration Myanmar are reported to have discovered an oil and gas field offshore the southern coast of Myanmar. The Aung Zya test well No 1 is located in block M 12, just 40 km northwest of the Yetagun field.*

***Exxon Corporation has announced the** signing of a Memorandum of Understanding with CIM Resources Ltd of Sydney, Australia, for the sale of Exxon's Australian coal assets. The deal includes Exxon's 100% interest in Lemington Coal Mine, its 36% holding in Ulan Coal Mine and its 44% holding in Mount Thorley Coal Loading Ltd. The deal is expected to be finalized in early 1998.*

NEWS Upstream – In Brief

Dana Petroleum, the Irish exploration *group, is intending to launch a new UK incorporated holding company, Newco – also to be called Dana Petroleum plc – subject to the approval of the High Court of Ireland and shareholders of the company. Under the scheme, shareholders will receive one Newco share for each Dana share held.*

Repsol, as operator of a consortium, *has signed an exploration and production agreement for the so-called A and B blocks in Libya. The blocks covering an area of approximately 23,000 sq km are in the Murzuq Basin. The work to be carried out includes seismic studies and a drilling programme. The consortium comprises Repsol (operator) 32%, OMV 24%, Total 24% and Saga 20%.*

Lasmo reports that it has discovered *oil in the Murzak Basin in southwest Libya. It is thought that the discovery could have an initial production rate of 10,000 b/d.*

Shell has acquired from German company *Veba Oel Kasachstan a 60% stake in the production sharing agreement for the Temir block in western Kazakhstan. Veba Oel will retain the remaining 40%. Shell will act as the new operator and has created a new company called Shell Temir Petroleum Development.*

It has been reported that the Chechen *Government has begun to restructure its oil industry by splitting its Southern Oil Company into four independent state-run businesses – Grozneft, Groznensky Orgsintez, Groznefteprodukt and Caucasian Oil Pipelines.*

Canadian regulatory authorities have *recommended that the $1.5bn, Mobil-led Sable Offshore Energy Project and its associated pipeline system be allowed to pump east Canadian gas to the Atlantic provinces and northeast US. The project includes the development of six natural gas fields off the coast of Nova Scotia and construction of a pipeline designed to carry some 460mn cf/d of gas through Nova Scotia, New Brunswick into Maine, New Hampshire and Massachusetts. First gas is expected in 1999.*

Tullow Oil has announced that the *Ranikot zone of its Suri well in block B onshore Pakistan has tested at a rate of 12.2mn cf/d. Tullow estimates that this zone should be capable of producing in excess of 20mn cf/d of gas when put into production. The discovery is located 10 km from the current Sara field development.*

Four new oil wells are reported to *have entered production in western and central Cuba. Three of the wells are producing at 1,500 b/d while the fourth is producing a lower volume of extra light crude oil. Drilling at a further 10 onshore and offshore sites is planned over the course of the next year.*

Elf reports that the onshore exploration *well Atora 1 located on the RGA 11 licence north of Gamba in Gabon has flowed at 3,300 b/d of oil.*

Production is reported to have begun *from Woodside Petroleum's Hermes field offshore Western Australia. Output is expected to increase from an initial 8,000 b/d to 20,000 b/d by the end of February 1998. The field is estimated to hold 27mn barrels of oil.*

Halliburton has received a Letter of *Intent from Petronas Carigali (Turkmenistan) to provide integrated drilling services for an exploration and appraisal programme in the Caspian Sea beginning in late 1997. The project award is estimated to be worth $30mn.*

Enterprise Oil is reported to have discovered *a new gas field off the Bulgarian Black Sea port of Varna. Field reserves are estimated at 1.8bn cm.*

Santa Fe Energy Resources and *Marathon have announced a second wildcat discovery on the Kowe block offshore Gabon. The Tchatamba South No 1 wildcat well is reported to have flowed at a combined rate of 8,165 barrels of oil per day.*

Mobil has announced a natural gas *and condensate discovery on the North West Shelf, Australia. The Athena-1 discovery well drilled in permit WA-248-P flowed 47.4mn cf/d of gas and 2,133 b/d of condensate.*

Wedderburn Securities has purchased *Anglo Caspian Oil for a consideration of £4.63mn. The assets of Anglo Caspian are $1mn in cash plus a 70% interest in the net income of Kezbi Anglo Munai, the Kazakh company responsible for oil production from the Kamenistoye field in the Aktau region of Kazakhstan.*

The Government of Ghana and Ghana *National Petroleum Corporation have signed a second petroleum agreement with Nuevo Ghana Inc for petroleum rights covering in excess of 2.7mn acres offshore Ghana in the central basin and area south of Accra.*

Energy Africa has entered into a technical *cooperation agreement with Soekor on blocks 3B and 4B in deep water off the west coast of South Africa. The work commitment involves the reprocessing of seismic data and an integrated technical and economic evaluation.*

China National Petroleum Corporation *has secured a 20-year oil exploration licence covering two blocks in Venezuela's third licensing round. It bid $358mn.*

Colombia is reported to have made a *number of changes to contract terms for exploration and production in the country in a bid to boost private sector exploration activity in unexplored areas and to offer greater incentives for natural gas production.*

Scana Corporation of the US is *reported to have announced plans to sell its wholly owned oil and gas exploration and production subsidiary Scana Petroleum Resources to Kelley Oil & Gas Corporation for $110mn.*

Kerr-McGee is reported to have *formed an alliance with Offshore Oil and Gas Corporation America, a subsidiary of the China National Offshore Oil Corporation, covering seven blocks in the Gulf of Mexico. Kerr-McGee holds a 40% interest in, and will act as operator of, each of the blocks.*

India's Petroleum Ministry has finalized *and signed production sharing contracts for a total of 26 exploration blocks. No further details are available.*

China Offshore Oil Nanhai West *Corporation's Wenchang 13-1-1 well in the western sector of the South China Sea is reported to be producing at a daily rate of 2,083 cm of oil and 13,075 cm of gas while its Wenchang 13-2-1 well has a daily output of 899 cm of oil.*

Norwegian shipowner John Fredriksen *is to float a new offshore drilling company with assets of $400mn. Northern Offshore's core assets are the* Canmar Explorer II *and* Canmar Explorer III *drillships and the* Northern Producer *semi-submersible production facility.*

Apache Corporation has completed a *new pay discovery on the Pecan Island field in South Louisiana's Vermillion Parish. The Goodyear #2 well flowed at a daily rate of 8.2mn cf of gas and 415 barrels of condensate.*

NEWS Downstream

New NGL processing partnership

A new partnership has been formed by Statoil (58%), Saga Petroleum (17%), Mobil (10%), Norkse Shell (8%), Total (5%) and Norske Conoco (2%) to transport natural gas liquids (NGLs) and condensate for processing at Mongstad in western Norway.

The Vestprosess partnership plans to build and operate pipelines linking Norsk Hydro's Sture crude oil terminal and the Køllsnes gas treatment plant run by Statoil to a new plant at Mongstad which will convert the NGLs and condensate to propane, butane and naphtha.

According to Statoil, the partnership aims to 'exploit synergies between the three plants as well as processing opportunities at Mongstad, where we already operate a refinery and crude oil terminal.

'Processing more than 1mn tonnes of NGLs and condensate from Norway's Troll and Oseberg fields will yield commodities with far greater value and a broader market than less refined products.

'Vestprosess will also help to strengthen the regional industrial base', states Statoil which has already secured an agreement to supply feedstocks from Vestprosess to the Noretyl plant operated south of Oslo by Copenhagen-based Borealis petrochemicals group.

Construction is expected to begin this month. The project is scheduled to be operational on 1 October 1999. Investment costs are put at NOK1.2bn.

Ofgas opposed to widening utilities' remit

UK gas industry watchdog Ofgas has opposed the UK Government's proposal to widen industry regulators' discretionary powers to include social and environmental issues. In a submission to the UK Department of Trade and Industry's (DTI) review of utility regulation, Ofgas stated that regulation should be 'confined to economic issues'.

Ofgas also stated that there would be 'advantages' in the proposed appointment of a single utilities regulator if 'backed up by the rigorous oversight of an effective appeals process based on a specialist panel of the Monopolies and Mergers Commission (MMC) and/or Competition Commission. It considers a statutory board of advisors to have 'more merit than the appointment of a panel of regulators' but points out that, to be fully effective, appointments to such a board should reside with the Director General – possibly subject to a published veto by the Secretary of State.

While welcoming the review of utility regulation in the UK, Ofgas stressed that it 'should not lose sight of the considerable benefits the present system has brought to consumers. Significant reductions in prices and improvements in services can be directly attributable to the decisions of the regulators. More recently, the extension of competition has brought further benefits. Nevertheless, there are areas where reforms might usefully be made.' Such reforms could include, for example, the merger of Ofgas with UK electricity watchdog Offer as the UK gas and electricity markets continue to converge as a result of market liberalization.

Trading venture focuses on the futures

The New York Mercantile Exchange (Nymex) and the International Petroleum Exchange (IPE) are to jointly develop an advanced electronic trading system that is claimed will provide greater efficiency for their mutual customers and serve as a standard for the oil, natural gas, electricity and coal industries.

The system will be based upon the IPE's Energy Trading System (ETS) as the core platform, which, according to Lynton Jones, Chief Executive of IPE 'has already proved itself' by 'successfully trading the IPE's new natural gas contract' launched in January 1997.

The new system is expected to 'serve as a significant enhancement' to both the current Nymex AccessSM and ETS systems, incorporating the functionalities of both systems, with the two exchanges co-developing and sharing costs equally.

Commenting on the planned joint venture, Nymex President R Patrick Thompson said: 'Since launching Nymex AccessSM in 1993, our goal has been to globalize energy futures markets into a seamless, virtually round the clock trading day – a goal that this agreement brings us one step closer to achieving. This understanding not only allows us to combine forces and share expertise, but also provides a framework for jointly promoting the advantages of exchange-traded energy futures and options contracts as the safest and most liquid risk management tools available.'

In Brief

***It has been reported that Finland's** Kesoil service station chain is to be grouped under the Neste brand. The joint network includes around 400 service stations and 200 automatic petrol outlets. While the deal entails no ownership changes, the Kesoil sites will be rebranded under the Neste name.*

***Pogo Producing Company and its Thai** partners have signed an amendment to their long-term gas sales agreement with the Petroleum Authority of Thailand to include the Benchamas/ Pakakrong field.*

***US company Caltex has strengthened** its position in Thailand's fuel retailing sector with the acquisition of British Petroleum's 48 outlets for an undisclosed sum. The sale increases Caltex' Thai service station network to some 600 sites.*

***US company Unocal is reported to** have signed a letter of intent with Koc Holding for the creation of Turkey's first private energy distribution and maketing company.*

***British Gas has announced plans to sell** electricity to its UK customers at discounts averaging 15% off current prices. According to the company, it will be the only new supplier to enter the UK electricity market when it opens up in 1998 and will be the only national supplier of both gas and electricity. British Gas has also recently announced price reductions of up to 26% from January 1998 for its UK gas customers.*

***It has been reported that BP has** signed a letter of intent to sell 1mn tonnes of Alaskan crude oil to China during 1998.*

***National Power and Kvaerner** Construction are to build a £25mn, 60MW power plant at Seal Sands on Teesside. National Power Cogen will fund and operate the facility which will supply the electricity needs of Phillips Petroleum's Seal Sands terminal.*

***Mobil, PdVSA of Venezuela and** Germany's Veba Oel are reported to have signed a $1.9bn agreement to upgrade the extra-heavy Cerro Negro crude oil that is due to come onstream in 1999. Some 60,000 b/d of oil will initially be produced from the field, which is located in Venezuela's Orinoco belt. This figure will rise to 120,000 b/d in 2001.*

New petroleum research centre for Australia

A new national research centre for petroleum and minerals is to be established in Perth, Western Australia. The proposed four hectare site will be located in the expanded Technology Park at Bentley, Perth and will employ some 170 people, 100 of which will be recruited locally.

The centre is scheduled to open in 1999. Research will focus on a number of topics, including petroleum exploration and production, geodynamics in mineral exploration, exploration geophysics, regolith exploration, mine systems engineering and minesite rehabilitation.

The expanded Technology Park will also accommodate a proposed petroleum industry training centre and possibly other oil, gas and minerals research centres.

The State Government is contributing some A$40mn to the project.

Global fuel card and telephone service

Fuel card provider Harpur Card Services and advanced telephone services company TCS (UK) Ltd have announced a global partnership under which holders of existing fuel cards managed by Harpur will be able to use their cards to access a national and international telephone service from any touch-tone phone. The new service will initially be available to Harpur's existing 1.3mn corporate fuel card customers.

A customer simply dials a freephone telephone number and uses the existing fuel card number and a unique four-digit PIN to access the service. Calls can be made from almost any telephone and charges are consolidated on to the fuel card invoice.

According to Harpur, the service provides savings of up to 30% over national carrier alternatives such as BT payphones, BT chargecard, mobile phone or hotel tariffs.

The service can be tailored to include branded audiotext messages and one-touch features such as seamless access to freepages, helplines and personal voicemail. Harpur also states that there is the potential to add other services such as links to traffic or city information.

Whopper deal for Shell service stations

Shell and the Burger King chain have signed a deal under which the oil company will redevelop a number of its UK service station sites to include sit-down restaurants.

The first of these is proposed for Salford Quays in Manchester and is scheduled to open at the beginning of this month. The redeveloped site will comprise a new petrol forecourt, Shell Select shop and Burger King restaurant which will provide seated accommodation for 30 customers, parking for 14 cars as well as a 'drive-thru'.

To facilitate fast-track development, a number of new construction techniques are being evaluated, including the use of a timber framed building system by Prestoplan which is designed to provide a fully waterproof building shell within a matter of days.

Snapshot of UK October fuel prices

	Pence per litre
Diesel	
Lowest: Glasgow	62.62
Highest: Aberystwyth	66.13
National average	64.36
Unleaded petrol	
Lowest: Bradford	62.76
Highest: Aberystwyth	67.21
National average	64.47
Four-star petrol	
Lowest: Halifax	66.86
Highest: Cambridge	71.42
National average	69.63

Source: *PHH Allstar Fuel Report*

Automatic diesel service

Kuwait Petroleum (Q8) has opened seven fully automated diesel service stations in Ireland, the first of their kind in the country. Q8 operates a network of around 400 such sites on major transport routes, country frontiers and important transport and trading centres in Europe through its International Diesel Service (IDS).

Drivers purchasing fuel or lubricants are issued with an IDS card, protected by its own PIN. The card is inserted at the pump, eliminating the need to queue at a payment kiosk. The system is said to help fleet operators to monitor expenditure, with detailed invoices showing the time, location and quantity of fuel drawn for each driver. Inclusion of the relevant VAT details makes reclaim procedures easier to process, states Q8.

The company is also to launch a route planner on CD-Rom in the near future.

In Brief

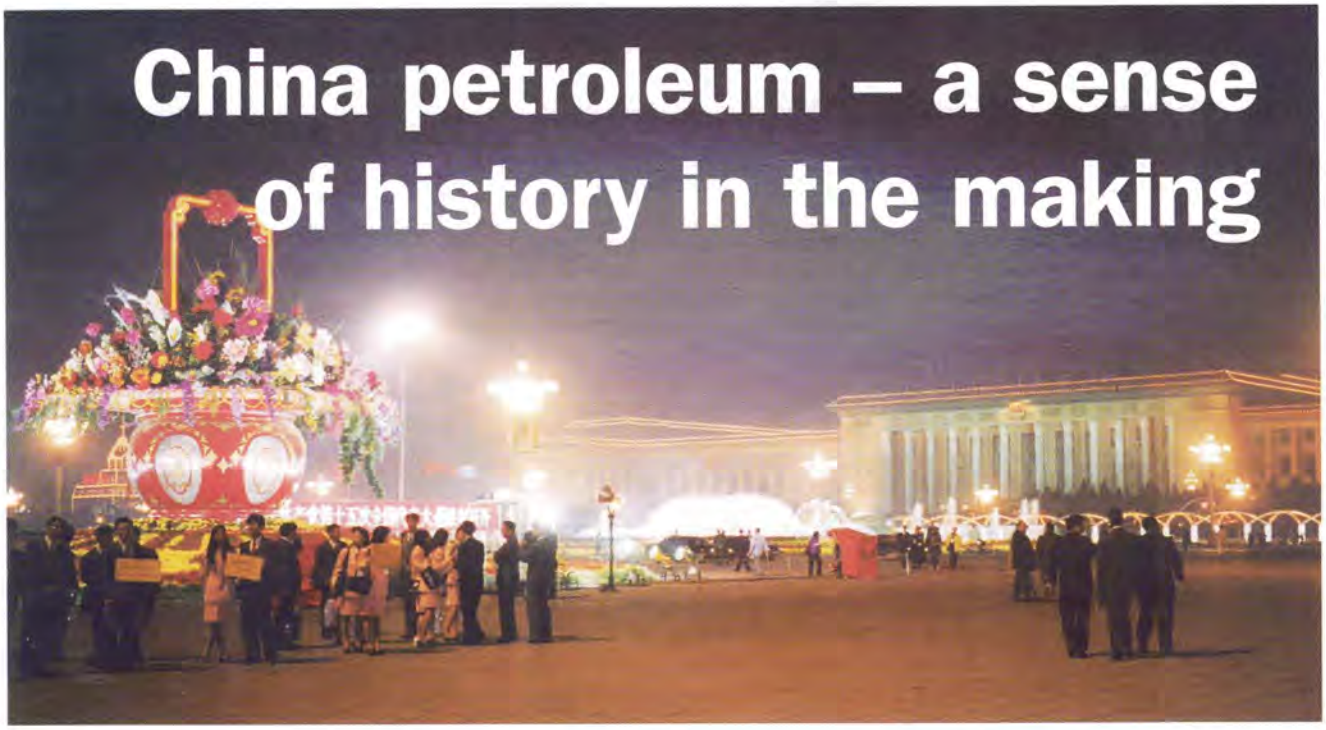
The European Union has set a target *date of 8 December 1997 for agreement on plans to open up Europe's natural gas market to competition. The original plans for liberalization of the £60bn per year market look set to be scaled down following opposition from several countries, including France which is not prepared to undermine its national monopoly Gaz de France. The plan was to initially open 28% of the market to competition, rising to 40% after five years and 45% after 10 years.*

State-owned Petroleum Authority of *Thailand has been given the green light from the Thai Government for the construction of an 8.4-km gas pipeline through the Sai Yok national park in the Kanchanaburi border province. Linking Thailand and Myanmar, the new pipeline will carry gas from the Yadana gas field offshore Myanmar to the Ratchaburi power plant in Thailand.*

A consortium comprising US company *Unocal, Delta of Saudi Arabia, Japan's Itochu Corporation and Inpex, Pakistan's Crescent Group, South Korea's Hyundai and the Turkmenistan oil and gas ministry is to construct a new 1,464-km gas pipeline linking Turkmenistan to Pakistan, via north Afghanistan. Russian company Gazprom is also expected to join the consortium shortly. The $2bn pipeline, which is due to be operational in 2000, will be capable of handling around 20bn cm of gas annually.*

UK Government consent has been *given for the construction of two combined heat and power (CHP) schemes – one at British Steel's Port Talbot Steelworks and the other at Esso's Fawley refinery in Hampshire.*

China petroleum – a sense of history in the making



Paul Tempest, Director General of the World Petroleum Congress (WPC), records his impressions of the 15th World Petroleum Congress and International Petroleum Exhibition held last month in Beijing.

The elaborate arrangements for the 15th World Petroleum Congress under the patronage of President Jiang Zemin, reflect the arrival of China among the top half-dozen oil producers in the world. China is already the world's largest coal producer and a major natural gas producer. Yet China is facing a serious energy policy dilemma.

Some 58 chairmen of major corporations, 38 Ministers and 5,186 delegates assembled for a week of high level discussions and carefully prepared technological exchange and review, with the Chinese hosts deploying a total staff of over 800. It was by far the most meticulously organized congress in the 65-year history of the WPC and was followed by an extensive programme of site visits to all parts of China.

Tianamen Square, the largest in the world, was especially decorated with flowers, illuminated and closed to the general public. A red carpet carried the delegates, diplomatic corps and top cadres of the Chinese Administration from the square into the still forbidden part of the Forbidden City, where for the first time for this sort of purpose, The Temple of the Imperial Ancestors, built in AD 1520 and renamed by Mao 'The Working People's Palace', provided a dazzling backdrop to a reception and entertainment for 8,500 guests. Then followed a comprehensive introduction to Chinese regional cuisine. Earlier the Great Hall of the People had provided an equally impressive venue for the Opening Ceremony and musical, gymnastic, opera and ballet entertainment where 4,800 guests were served a 24-course banquet simultaneously without the slightest fuss or delay. A half-hour fireworks display had showed how computerized control will revolutionize firework displays in the 21st century. The Chinese, who invented the art, were again effectively demonstrating a new technological ascendancy and an ability to cope with large numbers, just as their medieval invention of the compass also changed the course of human history and gave man a new sense of direction.

The scale of China, one-fifth of humanity, is ever-present. Walking around the Temple of the Imperial Ancestors with Wang Tao, for 11 years the President of the China National Petroleum Corporation, reminded me of my first meeting when I asked him how many people worked for CNPC. One point six, perhaps one point seven, he had replied. No need in China to even mention the word million. By comparison, the current worldwide staff of the two most powerful oil and gas multinationals in the world, Exxon and Shell, each are close to 100,000 which was the range of uncertainty conveyed by Wang Tao's reply. On this hallowed spot, I could not help but think that even the Imperial Ancestors themselves might not be too displeased with this brilliant, creative display of traditional skill and rediscovered culture, so long stifled by revolutionary zeal, conformity and narrow mindedness.

The Ying and Yang, the compass and the gunpowder, the firework and the fountain, the power and the poverty. Contrasts spring readily to mind in China. As far as petroleum in China is concerned there is good news and there is bad news.

As far as domestic petroleum production is concerned, there is very good news. The heirs of the Chinese drillers who 2,500 years ago perfected the techniques of drilling many feet through solid rock and distributing natural gas by bamboo pipeline have reason to be pleased. The scale and style of the 15th World Petroleum Congress demonstrated beyond doubt the willingness of the Chinese authorities to attract foreign capital and the scramble by the foreign companies to secure a foothold.

Only within the past five years has China moved from being a net exporter of oil to being a major and growing importer. Domestic production is unlikely to keep pace with demand. The implications of this imbalance for the next two decades are profound. China must have its incremental oil to underpin its continued and remarkable level of economic growth. This gives added urgency to the search for new domestic resources, but it also signals increased economic dependence on external supply focused on the Gulf. There is a perceived geo-political imperative to forge a political and commercial partnership with the three largest (and most unpredictable) leviathans of petroleum supply – Iran, Iraq and Saudi Arabia. Countries whose mutual antagonisms remain the cornerstone of US containment policy and protection for the industrialized world against a repetition of the deeply damaging Gulf supply discontinuities of 1973/74 and 1979/80. China's potential exposure to economic dependence and to the political turbulence of the Middle East is a very raw nerve in their thinking.

The 15th World Petroleum Congress demonstrated beyond doubt the willingness of the Chinese authorities to attract foreign capital and the scramble by the foreign companies to secure a foothold.

Among the Congress plenary speakers, the Secretary General of OPEC and the Executive Director of the International Energy Agency had therefore more to say than the predictable rhetoric of consumer/producer dialogue. This has become more or less irrelevant as the global oil and gas markets have taken over fully the role of price-setter and supply-allocater. The markets today also indicate, perhaps too easily, a very low chance of further global supply discontinuity. The IEA is concerned that China, unlike other major importers, does not hold the recommended 90-day level of strategic stocks as a cushion against supply interruption. OPEC, on the other hand, foresees, with some enthusiasm, the emergence of one large new customer which within 10 years could begin to rival the oil import dependence of Japan, Western Europe and the US.

What China thinks it needs most at present is advanced technology to maximize domestic production of oil and gas and, if possible (but unlikely), to achieve self-sufficiency. What it really needs is new technology to make the existing supply go much further. Further relaxations on the bans of the private use and ownership of automobiles indicate an imminent surge in the national stock of vehicles with incalculable consequences for demand for imported petroleum.

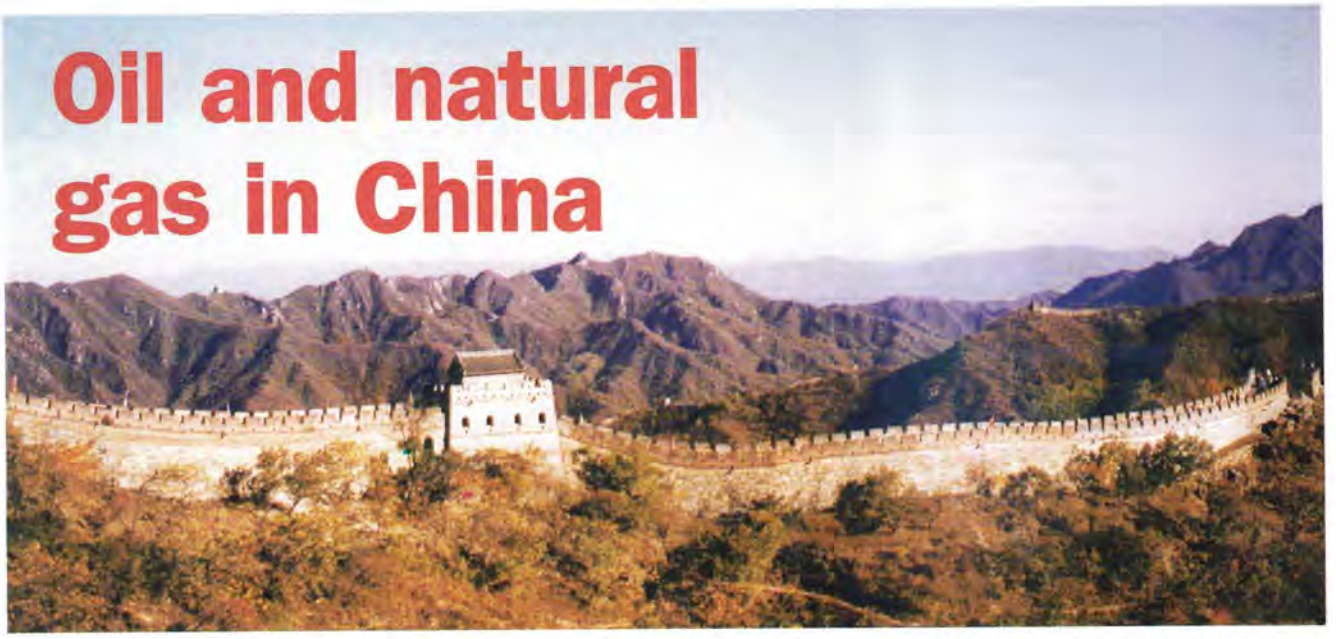
Already in Florida and California the prototypes of family saloons with hybrid engines not much larger than a bicycle pump, composite lightweight bodies and elaborate but cheap electronics have been tested and run for the last five years. They use about 20% of the petroleum consumed today by the average family saloon. The world record for distance travelled in a powered vehicle using one gallon of petrol is now approaching 1,000 miles. There is therefore immense opportunity now for increasing the efficiency of automobile fuel consumption.

For the Chinese a quantum jump in vehicle efficiency would provide solutions to many of their energy problems. Yet, from their point of view, the automobile, steel and petroleum industries in North America, Europe and Japan appear reluctant to forge ahead in this direction. Indeed several key Chinese experts I have talked to find it difficult not to conclude that the Chinese economy is faced with a competitive conspiracy of free market forces, institutional self-interest and imposed technological delay which works to the disadvantage of the entire less-developed world. While the world's bankers and oil industry personnel have no difficulty in financing new exploration and production for oil and gas without too much consideration of the environmental impacts, the new technologies of efficient energy use are starved of capital, bought up at distressed prices, stifled and shelved.

Governments, for their part, rant on about environmental protection but have neither the will nor the wit nor the wherewithall to provide effective stimulus to new technologies of energy use. They excuse their lamentable lack of interest by a naive belief in and reliance on market forces to solve this and other problems.

The usual answer given in the West to these allegations is that too much is being expected too soon. That is probably right. Nonetheless, I think that the Chinese have a point which needs addressing seriously.

Oil and natural gas in China



In his keynote address to the 15th World Petroleum Congress in Beijing, Wang Tao, Senior Advisor and former President of China National Petroleum Corporation (CNPC), summarized the current position of the Chinese oil and gas industry, examined future prospects and called for international cooperation to develop oil and gas resources. The following is a slightly shortened version of his speech.

Gas reinjection well in the Dazhangtuo condensate field, part of the Dagang oilfield complex

China was one of the earliest countries to discover and use hydrocarbon resources. However, by the late 1940s, only a few small oil and gas fields had been discovered in western China and no exploration had been carried out in 90% of the country's territory. Crude oil production and refining capacity were just 2,400 b/d and 3,500 b/d respectively.

Since the founding of the People's Republic of China in 1949, the petroleum industry has expanded rapidly. By 1978, China had become one of the world's major oil producers with crude oil production exceeding 2mn b/d.

Since the reforms in 1978 which opened China to the outside world, the expansion of the oil industry has accelerated. Proved oil and gas reserves added in the last 18 years are 1.27 times and 5.5 times the reserves found from 1949 to 1978. Oil and gas production in 1996 was 3.14mn b/d and 1.94bn cf/d, 51.1% and 46.5% above 1978 levels respectively.

Twenty-four centres

By 1996, 24 of China's 31 provinces and autonomous regions had found hydrocarbon resources. Twenty-four oil and gas producing centres had been established, including: Daqing, Shengli, Liaohe, Xinjiang, Sichuan, Tarim, Bohai Bay, and South China Sea.

Today, China has more than 20 large refining/petrochemical complexes with a combined refining capacity of 4.2mn b/d. Oil and gas production now accounts for 19.1% of primary energy consumption compared with less than 1% in 1949.

However, the rapid growth of the economy is increasing oil demand and Chinese oil production can no longer meet the demand growth. Since 1993, China has imported more oil than it has exported. In 1996, net oil imports accounted for around 8% of total consumption. Current estimates are that to maintain the modernization drive oil consumption will rise to 3.9mn b/d by 2000 and 5.3mn b/d by 2010.

However, China has the potential to meet most of its future requirements from domestic oil/gas production. China is rich in petroleum resources. The latest assessments, made in line with the prevailing world standards, show that the ultimate recoverable oil resources in China are 102bn barrels. By the end of 1996, the cumulative proved recoverable oil reserves were 38bn barrels, with a further 64bn barrels to be proved.

Non-conventional

China also has abundant non-conventional oil resources, such as extra-heavy oil, bitumen and oil shales. Oil shale resources alone account for 483.1bn tons, 31.1bn tons of which have an oil content of over 5%.

Oil production in China is increasing steadily. Eastern China currently accounts for 75% of the total, and the region has been well explored.

Sustainable growth in national oil production depends on the maintenance of stable production in eastern China. Currently, most of the oilfields in this region have problems, like high water cuts and rapid decline rates. Application of advanced technology systems to control the water-cut, have effectively prolonged the field life.

Daqing, China's largest oil field, has maintained output at over 1mn b/d for 21 consecutive years using proprietary expertise, even though water cuts range between 60% and 80%. This production rate could be maintained until 2010 by water-cut control techniques and tertiary recovery technologies, which have proved economic and successful in pilot tests.

Eastern China still has exploration opportunities. Application of new geophysical methods in recent years has led to a better understanding of the geology and new discoveries have been made in both the frontier and mature areas. Every year over 700mn barrels of recoverable reserves are added in this region. It is expected that oil production levels will be maintained and that additional reserves will be found in this part of the country.

Strategic area

Western China is seen as a strategic area. Significant discoveries leading to new production have been made in the Tarim, Junggar and Turphan-Hami basins of the Xinjiang Autonomous Region. Similar results have been achieved in the Qaidam and Erdos basins on a better understanding of the geology and increased exploration. The development of low permeability reservoirs has also increased. By 1996, proved oil reserves in western China had reached 4.93bn barrels and production 396,000 b/d.

China's offshore oil industry has also developed rapidly. Production has increased from 25,400 b/d in 1990 to 300,000 b/d in 1996 in cooperation with foreign partners. Offshore China has considerable potential and latest assessments are recoverable resources of around 21bn barrels. Further increases in reserves and production are anticipated particularly in the Bohai Sea and South China Sea.

Natural gas

China also has abundant natural gas resources. The acceleration of natural gas development and utilization will be critical in minimizing the oil supply problem. It is also important for environmental protection and the optimization of energy consumption. Ultimate recoverable gas resources in China amount to 370tn cf. By 1996, proved recoverable gas reserves were 42.6tn cf. However, natural gas only accounts for 1.7% of primary energy consumption. Over the last few years, a group of giant, and medium-sized gas discoveries have been made in the Erdos, Sichuan, Tarim, Junggar and Qaidam basins as well as in the west of the South China Sea. Between 1991 and 1996, 21.3tn cf of recoverable gas reserves were proved up enabling even faster growth of the gas industry.

East meets west on a crowded Beijing street

China now is accelerating the development of gas fields and the construction of associated downstream facilities. New gas pipelines, such as South China Sea to Hong Kong, Shanshan to Urmuqi of Xinjiang, Shanxi to Beijing, and Jingbian to Xi'an, have recently been brought into operation. It is expected that in the next 10 years, major gas producing provinces with production capacities of 500mn to 1bn cf/d will come into being in Sichuan, Xinjiang, Erdos Basin and the South China Sea. Gas production is expected to reach 2.4bn to 2.9bn cf/d in 2000 and 5.8bn to 7.7bn cf/d by 2010, and its share of primary energy consumption to around 5% early in the next century.

Energy conservation

China has great potential for energy conservation. The more efficient use of hydrocarbon resources is one of the main ways of balancing the country's oil and gas supply. In addition to increasing oil production, the Chinese government always gives top priority to energy conservation. As a result, energy conservation in China is now improving greatly. However, the utilization efficiency is still low compared with that of many developed countries.

Improvements in science and technology are key factors in the development of the oil industry. In recent years, a fairly complete theory of petroleum geology has been developed by research efforts and technical exchanges with foreign companies. The industry also has a good understanding of the world's advanced technologies and has developed some of its own for conventional oil/gas exploration and development and tailored to the geology in China. The industry is very strong in terms of technical service capacity which enables it, every year, to shoot around 100,000 km of 2D seismic and 10,000 sq km of 3D seismic survey, to drill around 10,000 wells and to construct 1,000 km of long-distance oil/gas pipelines.

Large reservoirs

Guided by the theory of non-marine sedimentation, 36.5bn barrels of recoverable oil reserves have been found. Of this, 75% are in large reservoirs, each with reserves of over 146mn barrels. Around 160 smaller oil fields have been successfully developed in geologically complicated areas, such as Bohai Bay's faulted depression basin, which currently produce, 1.2mn b/d.

Studies of coal-generated oil and immature oils generated by thermal degradation of recent sedimentary organic material have led to new oil sources in many sedimentary basins. The large oil fields found in Jurassic formations in the Turphan Basin have distinctive features of coal-generated oil. Similar immature oil resources have been discovered in 19 basins, some discoveries having oil reserves in place

Tourist site beneath the Great Wall

of over 700mn barrels.

China is now leading the world in terms of water injection technology for large heterogeneous sandstone reservoirs. Enhanced oil recovery (EOR) technologies, such as polymer flooding and APS flooding, have been proved successful in pilot tests. Wide application of this technology could raise the ultimate recovery factor in Daqing field to 60% or more. The available production technologies, including formation damage control, stimulation and workover operations have made it possible for low permeability reservoirs to be economically developed.

China produced 260,000 b/d of heavy oil in 1996 by applying appropriate thermal technologies. Theoretical studies on gas generation and distribution as well as field operations over recent years have proved that China has 'Deep Basin Gas' and super giant fields similar to those in Alberta, Canada. The Erdos Basin is of this type and covers tens of thousands of square kilometres.

Coal-bed methane resources are widely distributed in the country. It is calculated that 212tn cf of gas is recoverable from coal strata less than 1,000 metres deep.

Harsher environments

The Chinese oil industry is facing new technical challenges. Exploration and development activities are now moving into harsher environments. These include deserts and steppes, tidal zones and shallow seas, deeper target formations, low permeability and carbonate reservoirs. This requires increased investment in research and development as well as human resources training and the use of international technical exchanges.

International involvement

China, as a country that is developing rapidly and opening up, should join in the move to the globalization of the world economy, in trade as well as technology. Its oil industry, an integral part of the international oil industry, should be committed to domestic resources development, and to working closely with the world to develop in a mutually beneficial way. Since 1978, the industry has been expanding its cooperation with international partners. As a result, closer working ties with the world petroleum community have been established.

The growth of offshore petroleum industry in China symbolizes the success of the state reform and opening policy. In 1982, offshore China was first opened for international cooperation. To date, 126 petroleum contracts and agreements worth US$5.38bn have been signed with 67 companies from 18 countries and regions. Offshore oil production has increased at an average rate of 39.6%. This cooperation has brought advanced foreign technologies and managerial skills to the offshore oil industry, contributing a lot of valuable experience for the modernization of the national oil industry.

China's onshore oil industry was opened in 1985, including 11 southern provinces and autonomous regions; In 1992, another 10 northern provinces and regions opened, which made the total available acreage for cooperation up to 2.5mn sq km. To date, 37 petroleum contracts valued at US$1bn have been signed. Over the last 10 years, foreign credit loans, totalling US$5bn, have facilitated the expansion of production capacity and completion of some refining and petrochemical facilities. The imported technology and equipment have improved the technical strength of petroleum operations.

By opening to the outside world, China has started to play a role in petroleum exploration and development activities overseas. Contracts have been signed with a number of countries including Peru, Sudan, Venezuela, Khazakhstan, Canada, and Thailand. In addition, exports of petroleum technology and equipment as well as engineering and technical services into the international market are proceeding.

Opening to the outside world is the fundamental long-term policy of the state. Looking ahead to the 21st century, China wants to further develop the cooperative relations with the world oil industry on the basis of equality and mutual benefit, and does not mind whether the country is a developing one or a developed one, or the company is large or small. In line with international practice, more flexible terms acceptable to partners will be applied to international cooperative ventures, including enhanced oil recovery projects, downstream projects, long-distance oil/gas pipeline construction, research and development, and human resources training. More foreign capital, advanced technology and managerial skills could be utilized.

Unique skills

The complicated geology of China has provided the industry with experienced and highly qualified experts with unique skills and insights. This technology and experience is being made available to the world and particularly to developing countries in a variety of ways. Further ties will be developed with potential hydrocarbon exporters in order to improve oil/gas supplies to China.

The world is now more interdependent than ever before in terms of economic growth. The coming century will witness the rapid expansion of economic activity and the globalization of technology. The sustainable growth of the world petroleum industry is, as always, important for prosperity of the global economy. The Chinese oil sector is willing to join hands with its counterparts and work hard to make a more prosperous world petroleum industry in the coming century.

	August 1996		August 1997	
	Imports	Exports	Imports	Exports
Crude	1,877	2,371	3,422	1,549
Products	1,452	501	1,735	368

Source: China Petroleum Data Monthly

Chinese Crude and Products Imports 1996/97 (,000 tonnes)

A visit to the Dagang oilfield

One of the tours laid on by the Chinese at the recent 15th World Petroleum Congress was a visit to the Dagang oilfield on the shores of the Gulf of Bohai. *Chris Skrebowski* was one of the participants and records his impressions.

It was breakfast on board as four coach loads of delegates slowly extricated themselves from the smog and traffic of Beijing. All the main roads in Beijing sported WPC flags in a variety of colours for the duration of the Congress and as we reached the outer suburbs their absence suddenly became apparent.

Beijing does not have suburbs in the same sense as in the west and the change from urban to rural is quite abrupt. A change made all the more noticeable by the fact that we had now joined the 108-km Jingjintang expressway at the edge of the city and were speeding through the countryside on this fine new motorway. The road covered just over half of the 190-km journey from Beijing to Dagang and the rest of the trip involved small towns and industrial areas on the outskirts of the city of Tianjin.

Although the Chinese refer to Dagang as a single oilfield, it is in fact an entire oil and gas producing basin complete with its own town, refinery, factories, schools, workshops and associated facilities.

A plethora of 15th WPC flags greeted our approach to Dagang – our welcome further confirmed by police escorts racing the entourage through junctions and traffic lights. The town appeared spotless and litter free – had it been specially cleaned? The lack of the general urban detritus found back home suggested that the Chinese were tidy minded people and that litter is generally not a problem. We finally arrived at the main centre where we were treated as highly honoured guests (see pictures).

During the course of the presentation we learned that the Dagang oil and gas fields are found in the highly faulted and fractured Huanhua depression which has a number of uplifted portions providing a hydrocarbon prone area, onshore and offshore, of around 18,750 sq km.

When development work began in 1964 the area was predominantly salt marsh, meaning that virtually all of the town and the surrounding area was built on reclaimed land.

A great confidence that there is a long-term future for the fields – and the 70,000 people directly employed by the industry – is apparent. This is probably based on their success at maintaining production at around 4mn t/y for the last 30 years and the size of the resource base. It is estimated that the oil and gas resources of the basin are 2,560mn tons and 609.9bn cm respectively.

By the end of 1996 proved reserves amounted to 790mn tons of oil and 309.7bn cm of gas. Production in 1996 totalled 4.3mn tons of oil from the 15 producing oilfields and 360mn cm of associated gas. Cumulative production amounted to 93mn tons of crude and 12.4bn cm of gas. The current target is to raise onshore production to 5mn t/y and offshore to 0.5–1mn t/y by 2000.

The group company operating the fields and the 2.5mn t/y refinery was one of the 100 pilot companies first subject to market oriented reforms. The company currently consists of 59 'branch' companies and four subsidiaries which collectively are 53rd of 500 enterprises ranked by turnover in China.

Our tour featured a visit to see the gas recycling project in the Dazhangtuo condensate reservoir. Physically, the most notable feature of the project is the wells sited on an artificial island in the flood zone of the Duliujian river. The facilities were notably well kept with everything clean, tidy and operational. The contrast with a Russian facility could not have been more stark.

The aim of the two-well reinjection programme was to enhance condensate recovery by maintaining reservoir pressure. According to our hosts, in the period since the start of injection in July 1995 to May 1997 additional condensate production was 69,800 tons or 4.4%. The volume of gas injected over the period was 208mn cm and the overall pay-off was 204mn Renminbi over a two-year period. The project is seen as a great success and the intention is to apply the system to other condensate reservoirs in China.

A tour of the Geology hall and the Science and Technology hall (effectively small museums) provided two lasting impressions. The first was the pride and effort that had gone into the displays. The second impression was the abrupt change in the latter part of each display. Initially it was all hand-drawn maps and simple diagrams then suddenly 3D seismic plots and horizontal drilling diagrams.

Clearly the Chinese have been very good at applying the latest technology in the years since the country opened up. The town is home to the Dagang Directional Drilling Company which claims to be the largest directional and horizontal drilling company in Asia.

In a similar vein the oilfield equipment manufacturers in the Dagang Oilfield Group – Zhongcheng Machinery Manufacture and New Century Manufacture – have ISO 9000 certification.

Their one piece barrel sucker-rod pump is licensed by the American Petroleum Institute to use the API monogram. The equipment is well made and the implication is clear. Chinese labour costs are such that their oilfield equipment will be highly competitive in international markets.

What Lee Raymond actually said in Beijing

When Lee Raymond, Chairman and Chief Executive Officer, Exxon Corporation gave this keynote address at the recent World Petroleum Congress in Beijing, he drew attention to the way economic growth alleviates poverty and to the close linkage between economic growth and energy use.
He also drew attention to the weakness of the scientific evidence for climate change being caused by fossil fuel burning and his doubts about the wisdom of setting targets for the reduction of CO_2 emissions.
At a press conference after the presentation Lee Raymond assented to the suggestion that 'the European oil companies have been hijacked by the environmentalists'.
***Petroleum Review* has reproduced the full text of the speech so that readers can judge for themselves the merits of the arguments and their likely impact on the Kyoto conference.**

It's a pleasure to return to China and Beijing and an honour to address the World Petroleum Congress.

It's entirely fitting that we meet in this seat of ancient civilization and source of world culture. For centuries, people from far parts of the Earth have come to China seeking commercial and other opportunities.

The Romans came here seeking silk – traveling along a network of trails that became known as the Silk Road. In the 13th century, history's most famous traveling salesman, Marco Polo, took this road to Cathay, returning to Venice with treasures and tales that astonished all of Europe.

More than a century ago, William Herbert Libby, representing Jersey Standard, the predecessor to Exxon, came here to persuade Chinese families to try Esso kerosene in their lamps and cooking stoves.

The odourless oil and its clear white light proved an instant success, and by 1910 China had become Esso's largest customer in the Far East.

To build sales, Libby gave away small, inexpensive kerosene lamps that became widely popular. The company was known by the name 'Keepers of Light'.

Today, Exxon and the world petroleum industry are still 'Keepers of Light.'

We earn that title by providing energy to light the way to economic progress, higher standards of living and hope for a brighter future for people around the world.

Nowhere is that progress more evident than in the Asia–Pacific region.

I've traveled to this part of the world often in recent years, and I'm constantly impressed by the commitment to economic growth that's prevalent throughout the region.

All across this region – from Bangkok to Beijing, Jakarta to Shanghai, Singapore to Seoul – the signs of growth are unmistakable.

Homes, apartments and office buildings going up. Factories, refineries and power plants under construction. More cars, trains and airplanes on the move than ever before. In 15 years, this region's economy should almost double, shifting the global economic centre of gravity toward the East.

The people of this region, representing 40% of the world's population, have a lot to smile about: new and better-paying jobs, more and better consumer goods and services, and greater opportunities for the next generation. Their smiles and looks of hope and optimism are the human face on the economic transformation that's gaining force in Asia.

I know all of us here today want to see this transformation continue. But we have to remember that progress is not automatic. As recent economic difficulties in the region demonstrate, there is no guarantee when it comes to economic growth.

In fact, some argue that the easy growth from increasing capital and labor inputs has already occurred. They say that the road ahead will be more difficult and will require strong boosts in productivity to keep Asian economies growing.

I see no reason why economic growth can't continue strongly in this region in the future. But I do agree that sustained growth is only possible when it is built on sound fundamentals – education and training, a strong work ethic, sound regulatory policies, incentives to invest, and many other factors that don't come easily or cheaply.

We might also remind ourselves that this region's growth depends on strong economic ties with other parts of the world.

Advances such as fibre optic cable, communications satellites and the computer have created better tools for communicating and conducting business. As a result, opportunities and challenges flow more quickly from one area of the world to another.

Political change has also played an important role in laying a foundation for growth. As more and more governments have turned to market principles, trade barriers have fallen, fostering a rising tide of international investment and commerce.

One result of these changes is that the area of the world open for energy development has increased by more than one-third.

That's very good news indeed because, as we all know, economic growth and higher standards of living require energy. Energy use and economic growth are inextricably linked. The countries with the highest economic growth and the highest standards of living are also those with the highest energy use per capita.

Today, most of that energy, both in Asia and in the world as a whole, comes

from fossil fuels – about 85%. Of these, oil and natural gas supply the majority, with coal also being a major player. That's especially true here in China, where coal remains the dominant fuel source.

I know there are some people who argue that we should drastically curtail our use of fossil fuels for environmental reasons, and I'll have more to say about that in a moment. But let me state at this point my belief that such proposals are neither prudent nor practical.

With no readily available economic alternatives on the horizon, fossil fuels will continue to supply most of the world's and this region's energy for the foreseeable future. Their use is essential both for economic growth and for the elimination of poverty, which is itself the worst polluter.

In recognition of this, we must continue to develop and apply technology and expertise that enable us to use fossil fuels in ways that are efficient and environmentally sound. Doing that will require a great deal, from both government and the petroleum industry.

Looking specifically at oil, demand in the region has grown vigorously, increasing reliance on imports, despite efforts to develop indigenous supplies. China itself, with growth rates among the highest in the world, became a net importer in 1995.

I do expect some moderation in the rate of oil demand growth in all of the region as economies become larger, more sophisticated and efficient. But with the volume increase that is expected, I do not see how growing import dependence can be avoided.

In anticipation of this, it appears that supply strategies are changing, with Chinese and other Asian companies becoming more active in exploration in other parts of the world. But this change should not cause us to lose sight of the need to maintain and, if possible, increase local production and reserves.

Asia still has numerous areas with hydrocarbon potential. But it will take a major effort to unlock these resources for the benefit of consumers.

Increasingly, this is a difficult task, often involving seismic and drilling in deep waters or harsh terrain, with complex geological formations. Examples include the Sakhalin Islands off Russia and the Tarim Basin in China.

Developing such resources at an affordable cost is going to require the application of the very best technology and practices known to the industry. Private petroleum companies have those tools. And so, an essential step to achieve further progress is for governments to accelerate the opening up of prospective resources for development by private industry.

One resource with great potential for Asia is natural gas. But producing and using it will require some visionary thinking and the application of new and as yet unproved technology.

Vast resources of gas exist off Natuna Island in Indonesia, in Papua New Guinea, and along the Northwest Shelf of Australia, to name a few.

Others may develop along the Asia-Pacific coast as far north as Russia. And, of course, there are major gas deposits west of the region as well. The key issues are how to get this gas to markets, and how to develop markets once it is determined that the gas can be produced at reasonable cost.

Today, most gas is transported to this region as liquefied natural gas, LNG. In the United States and Europe, most gas moves through pipelines – as it will in South America in the years ahead. Could the same not take place in Asia ?

The distances are greater here, the markets less developed, but technology may yet lead the way to a pipeline grid serving the countries of this region. New high-strength steel and other technology may make pipelines feasible from Sakhalin, Natuna or as far away as Turkmenistan.

On the demand side, we estimate that oil for transportation and industrial use in the region will grow by nearly 10 million barrels per day by 2010.

That's equivalent to about 40 new large refineries over that period – three per year.

Of course, along with demand comes the need for improved products, new chemicals and better processes. Increasingly, refineries and chemical plants are integrated into single sites as we're seeing in Singapore, for instance.

Finding new and better ways to produce, refine and market oil in the midst of change is not new to the petroleum business. What is new is the remarkable pace at which the need for petroleum fuels and products is accelerating in Asia. Such conditions are creating opportunities for a synergy between governments of the region and private petroleum companies, with the potential to speed and strengthen the whole process of economic development.

Clearly, private companies such as Exxon have a lot to offer. Developing energy resources in new and difficult areas, building safe, reliable, and efficient refineries and chemical plants, and bringing new and better products to market are just a few of the contributions we can make.

We also bring hard-won technological expertise tested and proven in other areas of the world. This can make it practical to develop resources that would not have been economic just a few years ago. It can also lead to significant employment and educational opportunities. Time will not have to be spent in developing technology or training from scratch – they're already available without the growing pains.

Of course, all of this will require massive outlays of capital – financial, intellectual and technical. Projects will likely be large and complex, requiring multiple management skills. Familiarity with challenging environments, flexibility, and strong technological support will be key elements of a successful venture.

Private petroleum companies offer all of these essentials. But to draw on them, countries must be willing to provide incentives that cause companies to want to invest.

This is particularly true now, with so many new opportunities throughout the world. Competition among countries eager to develop petroleum reserves is at an all-time high. Resources are being stretched to the limit. To attract companies to make the huge investments needed, nations need to offer tax and take provisions that will encourage businesses to bring their best people and technology.

Governments also need to provide a stable investment climate, one that vigorously protects physical and intellectual property rights. They should avoid the temptation to intervene in energy markets in ways that give advantage to one competitor over another – or one fuel over another. Governments' goal should be to promote a fair contest on a level playing field.

Another key contribution governments can make to economic develop-

ment is in setting rational environmental standards. People the world over want a clean environment, and some are concerned that fossil fuel use – especially oil use – is incompatible with that objective.

Today, concern about the environment focuses on the issue of global climate change. In December, representatives from some 160 nations will meet in the beautiful city of Kyoto, Japan, to decide on legally binding agreements that would have the effect of cutting the use of oil and other fossil fuels. Clearly, all of us here today have a big stake in the decisions that will be made.

Proponents of the agreements say they are necessary because burning fossil fuels causes global warming. Many people – politicians and the public alike – believe that global warming is a rock-solid certainty. But it's not.

Let me briefly address three key questions: Is the Earth really warming? Does burning fossil fuels cause global warming? And do we now have a reasonable scientific basis for predicting future temperature?

In answer to the first question, we know that natural fluctuations in the Earth's temperature have occurred throughout history – with wide temperature swings. The ice ages are a good example.

In fact, one period of cooling occurred from 1940 to 1975. In the 1970s, some of today's prophets of doom from global warming were predicting the coming of a new ice age.

Some measurements suggest that the Earth's average temperature has risen about half a degree centigrade since the late 19th century. Yet sensitive satellite measurements have shown no warming trend since the late 1970s. In fact, the earth is cooler today than it was 20 years ago.

We also have to keep in mind that most of the greenhouse effect comes from natural sources, especially water vapour. Less than a quarter is from carbon dioxide, and, of this, only four percent of the carbon dioxide entering the atmosphere is due to human activities – 96% comes from nature.

Leaping to radically cut this tiny sliver of the greenhouse pie on the premise that it will affect climate defies common sense and lacks foundation in our current understanding of the climate system.

Forecasts of future warming come from computer models that try to replicate Earth's past climate and predict the future. They are notoriously inaccurate. None can do it without significant overriding adjustments.

Even then, 1990's models were predicting temperature increases of two to five degrees Celsius by the year 2100. Last year's models say one to three degrees. Where to next year?

As one climate modeling researcher said in the May issue of the prestigious magazine, *Science*, 'The more you learn, the more you understand that you don't understand very much.'

So the case for so-called global warming is far from airtight. You would think that all the uncertainty would give political leaders pause.

Unfortunately, it hasn't, and officials continue to insist that agreement is needed in Kyoto.

To achieve the kind of reduction in carbon dioxide emissions most advocates are talking about, governments would have to resort to energy rationing administered by a vast international bureaucracy responsible to no one. This could include the imposition of punishing, high energy taxes.

This heavy burden of taxes and regulation would take its toll in many ways – in slower economic growth, lost jobs and a profound and unpleasant impact on the way we live. Companies in industrialized nations that compete in world markets would be seriously handicapped.

Currently, most proposals exclude developing nations, including China, Indonesia and many other countries here in the Far East. The rationale is that these countries are trying to grow economically and need to consume fossil fuels to do so.

Of course, this is true. But excluding developing countries from the reductions will not prevent them from being hurt. Their exports will suffer as the economies of industrialized nations slow.

So all of us would suffer from these proposals. The US Senate recognized that fact this summer when it voted 95–0 in favour of a resolution expressing its concern about the proposals under consideration.

What should we do? First, let's agree there's a lot we really don't know about how climate will change in the 21st century and beyond. That means we need to understand the issue better, and fortunately, we have time. It is highly unlikely that the temperature in the middle of the next century will be significantly affected whether policies are enacted now or 20 years from now.

It also means it's bad public policy to impose very costly regulations and restrictions when their need has yet to be proven, their total impact undefined, and when nations are not prepared to act in concert.

Before we make choices about global climate policies, we need an open debate on the science, an analysis of the risks, and a careful consideration of the costs and benefits. In fact, in the US the administration says it is 'futile' to attempt to determine the impact on the economy in 2010 of reducing CO_2 emission although many studies indicate the impact will be vast.

So far, this has not taken place, and until it has, I hope that the governments of this region will work with us to resist policies that could strangle economic growth.

Fostering economic growth will require a broader understanding of the environment than many environmental activists seem to appreciate. The most pressing environmental problems of the developing nations are related to poverty, not global climate change. Addressing these problems will require economic growth, and that will necessitate increasing, not curtailing, the use of fossil fuels.

Such use does not mean inevitable environmental degradation. New technologies have allowed industrialized countries to enjoy both economic growth and environmental progress.

Studies in the economic community support this idea. A recent study at Princeton University found 'no evidence that environmental quality deteriorates steadily with economic growth.' Instead, it found that after an initial decline, a nation's environment improved as its economy grew.

So the real secret to environmental improvement is economic growth.

And as this growth continues, the economies of this region will need to import more oil, and, to a lesser extent, gas.

This growing reliance on petroleum imports will cause a major eastward shift in the politics of energy. Nations may form new alliances, some based on commercial interests, others on geo-political considerations. The temptation may be strong to make these exclusive or restrictive, reversing recent trends toward more openness and harmony.

I hope that such factionalism will not be the case. We need the smooth functioning of an increasingly interdependent world economic and energy system. And this requires that barriers to trade and to the free movements of goods, services and people be dismantled, not raised.

It also requires that nations practice energy cooperation, not selfishness and that they do so both in times of prosperity and of crisis.

Finally, some people say that, in pursuing economic development, Asia must follow a western model. I believe that the region must find its own way.

But I also believe that the most direct path is the one many countries in the region and around the world have chosen over the past 20 years – the free market approach. This approach has many antecedents, including the Chinese philosopher Lao-Tzu ('Loud Zoo').' He wrote in the sixth century BC: 'Govern a great nation as you would cook a small fish – do not overdo it.'

Future prospects for conventional oil supplies

We take the availability of cheap oil for granted, yet must ask how assured is its future supply. We continue to find more oil in old places using new ideas and in new places using old ideas, but what is the future of cheap oil?

This question was addressed at a recent (13 June 1997) workshop at the University of Reading (convened jointly by the departments of Sedimentology, Cybernetics and Engineering). The main issue discussed was that of the security of future oil supplies and was evaluated by 40 representatives from the petroleum industry (BP, BG, Amoco, Statoil, Enterprise, Chevron and Amerada Hess), governmental and quasi-governmental bodies (IEA, DTI and NERC), and the diverse areas of economics (RIIA), energy (IP, Centre for Global Energy Studies, Oxford Institute of Energy Studies), journalism and academia (including the Geological Society of London). A report by **Bruce Sellwood, Roger Bentley** and **Max Coleman.**

Under the chairmanship of Professor Roger Williams, the Vice-Chancellor of Reading University, the meeting focused on: probing the uncertainty in estimates of the future supply (versus demand) of conventional oil; identifying when cheap oil will become in short supply, and the scope for replacing cheap oil with other energy sources.

The workshop was addressed by Dr Colin Campbell who, using data he had collected in collaboration with Petroconsultants, provided a provocative but sobering view of declining reserves and declining discovery rates. His presentation provided a focus for much of the debate. Campbell's case is that we take cheap oil's abundant and continuing supply too much for granted and that we are encouraged in this view by many economists. Claims that there have always been reserves for 30 years into the future, and that there is no reason to doubt such a happy situation continuing, are still made in the press (eg Dusseault, MB 1997, *Nature*, 386, p12) but are unsustainable in fact.

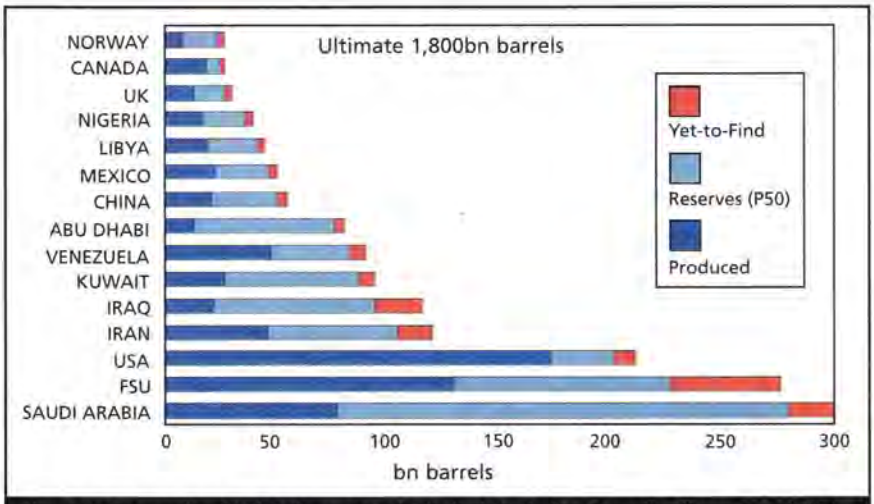


Figure 1: Conventional Oil Endowment of Principal Producing Countries (from Campbell, in press, *Science Spectra*)

Recent articles by eminent explorationists such as LF ('Buzz') Ivanhoe (*World Oil*, Nov 1996, pp91–94) also cast doubt on such bullish views.

Oil shock

According to Campbell, and reiterated in his recent book *The Coming Oil Crisis* (1997, Multi-Science Publishing Company, UK. Reviewed in *Petroleum Review*, November 1997, p525), the oil shocks of the 1970s made the world conscious of the issue of resource depletion but because that crisis soon passed, with Alaska and the North Sea coming onstream, by the late 1980s prices had slumped and oil depletion had disappeared as an issue. Since then another 3.6×10^{11} barrels (360bn barrels or 360Gbbl) have been consumed, equivalent to almost half the amount consumed since production began.

Most oil produced so far, as well as that to be produced over the next 20 years or so, he terms 'conventional oil', which flows at high rates from giant fields. It is easy, cheap and fast to produce. There is also 'non-conventional oil', embracing heavy oils, tar sand oil, oil shales, oil obtained by enhanced recovery and the like. But such oil represents a small and expensive fraction of the total production and can be produced only at relatively slow rates (currently at only about 2mn b/d or 3% of total production). Of course the boundary between the 'conventional' and 'non-conventional' changes with time, but using his own and the Petroconsultants' database he estimates the following:

- **Produced (784bn barrels):** to the end of 1996;
- **Reserves (836bn barrels):** remains to be produced from known fields;
- **Discovered (1,620bn barrels):** Produced + Reserves;
- **Yet-to-find (180bn barrels):** in new fields (Ultimate less Discovered);
- **Yet-to-produce (1,016bn barrels):** how much is yet-to-produce (Ultimate less Produced);
- **Ultimate (1,800bn barrels):** how much will have been produced when production ends;
- **Depletion rate (2.6%):** annual production as a percentage of the Yet-to-produce;
- **Discovery rate (<6bn b/y):** annual additions in new fields.

Estimates of reserves are made by well-understood technical procedures, but the accuracy of the estimates depends, in particular, on the complexity of the

geology: the simpler fields tend to be underestimated, whereas the more complex tend to be overestimated. For example, among 33 North Sea fields, he quotes a revision of reserve estimates which ranged from 69% downwards to 181% upwards. However, he notes that information in the public domain is becoming ever less reliable. Published estimates of global 'Ultimate' reserves have been on a downward trend from 3,500bn barrels in 1969 to a spread around 2,000bn barrels today. One popular method relates discovery peaks with production peaks, after given time lags; production is then extrapolated on 'bell-curves'. The North Sea, for example, contains an ultimate endowment of only about 60bn barrels, equivalent to less than three years of world demand.

Campbell believes that the world has now been so thoroughly explored that it is most unlikely that any new province of comparable size to the North Sea remains to be found, even if some more deep water finds are yet to be made. Some delegates at the meeting vigorously contested this view but specific locations were withheld on confidentiality grounds. Campbell's analysis suggests an ultimate global recovery of 1,800 to 2,000bn barrels, supported by the fact that the finding rate is falling and is currently less than 6bn barrels per year. Although several delegates disputed these figures, estimates provided did not generally exceed 2,500bn barrels, representing only 'a few years of grace' at current consumption rates.

A study of reported historical reserves shows large increases in the late 1980s and a more-or-less flat profile since. This so-called 'reserve growth' is often attributed to technological advance and better management, and is then extrapolated into the future, particularly by economists.

Campbell admitted that there have been significant advances in technology, which may have contributed to the upward revision of reserves, especially in the case of small deep-water fields. But the main factor in 'reserve growth', he contends, is due to the evolution from conservative estimates at the beginning of a field's life to more accurate estimates towards the end of a field's life. The huge reserve increases announced by several OPEC countries in the late 1980s, he insists, were unrelated to technology, and were reported then for quota share reasons only.

Oil yet-to-produce

Campbell's 1996 estimate indicates that there are just over 1,000bn barrels of conventional oil yet-to-produce, of which about 20% is yet-to-find. What is common to all types of production is that peak production occurs at approximately the same time as the midpoint of total yield, except where production is artificially constrained by allocation arrangements.

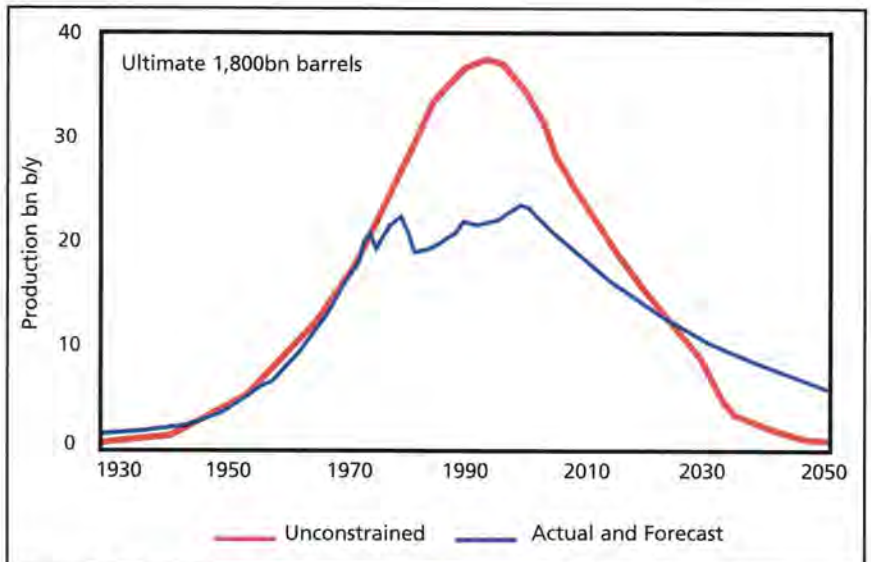


Figure 2: The World Total Oil Production (from Campbell, in press, *Science Spectra*)

This fundamental constraint provides a realistic resource-based mechanism for modelling depletion and forecasting future production, including the onset of chronic shortage. If the world were homogeneous, or if production were scrupulously controlled a well managed depletion might be expected, approximating to a shallow bell-shaped curve. In such a case prices would rise gradually as the transition to falling production was approached. But the world is not homogeneous: about half the 'yet-to-produce' lies in just five Middle East countries: Abu Dhabi, Iran, Iraq, Kuwait, and Saudi Arabia (**Figure 1**).

Different countries are at very different stages on their depletion curves. Some are past their midpoint and in terminal decline, for example the US; some countries are close to mid-point, such as the UK and Norway. However, the five Middle East countries are at a very early stage of depletion and can exert a 'swing' role making up the difference between world demand and what the others can supply. They can do this only until they themselves reach midpoint.

Production and demand

World demand is now rising at about 2.5% a year, and it would be even higher but for the economic collapse of the former Soviet Union. Looking at the world as a whole, we could model production of an 'Ultimate' 1,800bn barrels with a classic bell-shaped curve, but it is not a good fit (**Figure 2**). The rapid uncontrolled rise in production did indeed match the theoretical curve until the 1970s, when high prices and a change in ownership of the reserves led to an irregular plateau. In consequence,

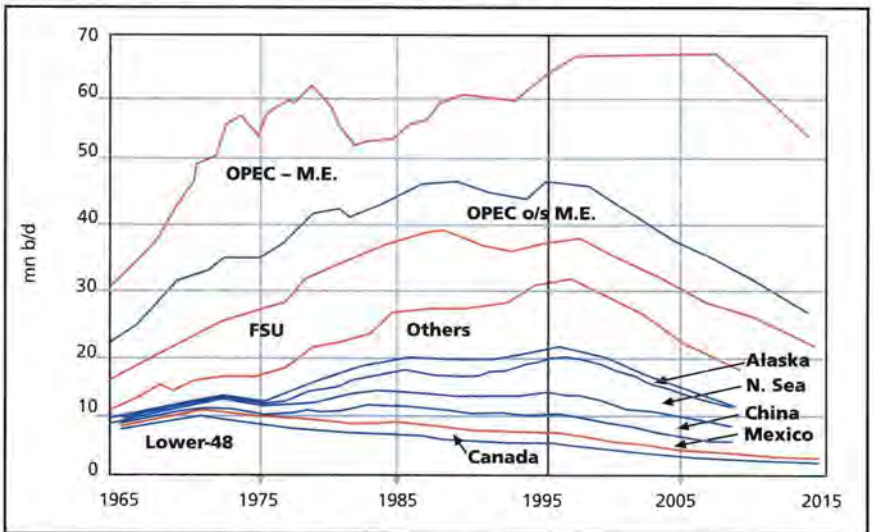


Figure 3: World Production of Oil by Country (from Campbell, in press, *Science Spectra*)

production will now decline at a slower rate than would have otherwise been the case. Campbell predicts that the world's midpoint of depletion will come when 900bn barrels have been produced (half of 1,800bn barrels) which, with 784bn barrels already produced, will be in less than five years' time. Assuming that this coincides with peak production, shortages could be expected, on this basis, to arrive in the early years of the next century. The exact timing of these events was a subject of considerable dispute, particularly by the economists present.

Middle East 'swing'

Such a model, however, ignores the critical swing role of the five Middle East countries and it seems better to model shortage, and the price of oil, on the basis of the share of production coming from these countries. Even the Caspian region is heavily constrained by political, fiscal and contractual factors. It is hard to predict exactly when this growing OPEC share will be translated into control of price, but the model indicates that a 30% threshold will be reached by 1998 (**Figure 3**).

Thus, Campbell argued, a radical increase in the price of oil can be expected before the turn of the millennium. That would be likely to curb further increases in demand so that actual physical shortage could be delayed for a few years, but this delay will depend on the Middle East 'swing' producers. However, by about 2008 they will be supplying 50% of the world's needs, and by 2013 will be close to the midpoint of their own depletion. Although much higher prices will cushion the effect, chronic shortages of conventional oil would be predicted to develop from around 2010 onwards (**Figure 4**).

Depletion patterns

Gas, he points out, is at a relatively early stage of depletion and is subject to a very different depletion pattern, being more subject to normal economic constraints. Production of gas is likely to grow to a peak or high plateau around 2020, allowing it to form a valuable substitute for conventional oil. However, it is in the area of transportation that the potential loss of cheap oil will make its effect most felt and where, without significant technological changes to aircraft and ship design, major problems will occur.

An alternative view was presented and emphasized that only a fraction of oil produced is used for transportation. [In 1996 gasolines accounted for 28.6% of global consumption with middle distillates accounting for a further 36.7%. Transport accounts for a half to two-thirds of middle distillate demand. Ed] Since there is already investment in substitution of gas for oil for power generation, this move will allow transportation to continue to use oil, thus delaying the demand crisis.

The world is using 24bn b/y on a rising trend, yet finding less than 6bn barrels on a falling trend. It is essential to bear in mind that 90% of current production comes from fields more than 20 years old and 70% from fields more than 30 years old. Furthermore, peak discovery was in the 1960s, despite technological advances and massive drilling activity since then.

On Campbell's analysis we are about to face the peak in production corresponding with intense exploration 30 years ago. The future trend, he argued, is towards decreasing production but with continuing increase in demand, a situation that cannot be sustained for long.

While not everyone at the meeting agreed with this rather dire conclusion, the general feeling was that this constitutes a serious situation and one that merits detailed examination through further research.

About the authors

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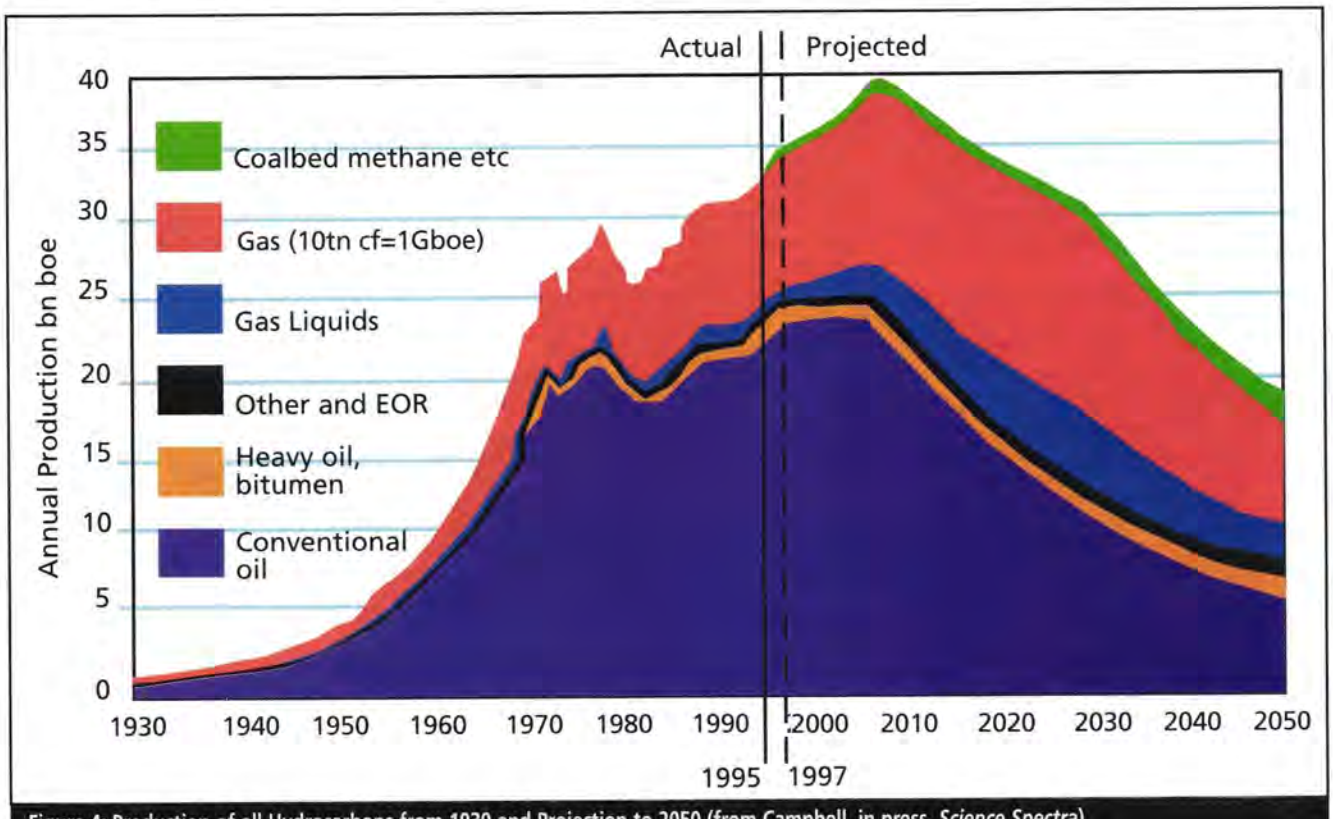


Figure 4: Production of all Hydrocarbons from 1930 and Projection to 2050 (from Campbell, in press, *Science Spectra*)

History points to steady growth for product tankers

In stark contrast to the fluctuating fortunes of the crude oil carrier, the global demand for petroleum product tankers has grown slowly and steadily over the last 25 years. This demand now stands at approximately 2.3bn tonne-miles, up from 1.2bn in 1972, reports *Mike Corkhill*.

Growth in the seaborne transport of refined products reflects, and has been driven by, the increasing consumption of oil in most parts of the world. Global oil consumption reached 3.06bn tonnes in 1996, 3.3% ahead of the previous year and 27.5% ahead of the level in 1986. Approximately 55% of the growth in oil consumption over the past decade has been in Asia.

In 1996 some 430.5mn tonnes of refined products were moved by sea, up from 378mn tonnes in 1994. Just under one half of this trade is comprised of intra-regional movements and the remainder deepsea shipments.

Product shipments have continued to rise in 1997. An important trade barometer is throughput at Rotterdam, Europe's premier bulk liquids port and an important entrepôt for balancing flows of refined products. Product imports and exports for the first half of 1997, at 9.2mn tonnes, were 38% ahead of the level recorded in the same period a year earlier, and represented the Dutch port's largest single traffic growth. Several major refineries have been modified to produce more diesel and petrol and this is reflected in a distinct shift from heavy to light products movements at Rotterdam in recent months. Imports rose 47% in the first half, with notable gains in movements of diesel from FSU countries and gasoline from Kuwait. Most of the 23% surge in exports was due to gasoline shipments to the US.

East of Suez focus

In line with global consumption patterns, the majority of new refinery capacity brought onstream over the past decade has been in Asia. Despite larger refinery throughputs close to the end-users in the Far East, the overall demand for product tankers has not been adversely affected. In fact, it has increased. This is primarily due to the increased demand for long-haul deliveries of feedstocks from Middle East export refineries, more regional balancing movements and local deliveries of finished products.

While the medium-range (MR) tankers of 40,000–45,000 dwt are well suited to the balancing movements of products in Asia, exports of 'volume' products from the Middle East eastwards, such as naphtha and residual fuel oil, are increasingly carried in long-range product tankers of the 55,000 dwt Panamax size (LR1) and the larger 60,000–85,000 dwt size (LR2).

The Middle East is the largest source of refined products in the world and Saudi Arabia exports more than any other single country. Of the 60mn tonnes of products shipped from Saudi shores in 1996, approximately 80% was directed eastwards to the Indian subcontinent and Asia. However, Saudi Arabia's ability to increase naphtha exports in the years ahead has been questioned, due to its ambitious plans to build up a domestic petrochemical industry and the likely local requirement for the product.

There are other countries ready to step in and fill the gap. Abu Dhabi is in the process of developing onshore gas reserves to augment output from its offshore fields. Completion of the first phase of its Onshore Gas Development (OGD) project allowed the United Arab Emirates to quadruple condensate production in 1996 to 4.7mn tonnes. Three-quarters of this volume was exported in large product tankers from the port of Ruwais, and shipments are forecast to rise to 6.5mn tonnes this year. Further OGD phases are set to boost condensate production to 14mn t/y by 2000. New refinery units due onstream by 1999 will convert much of this condensate feedstock to unleaded petrol and other products, so by the turn of the century Abu Dhabi exports eastwards will comprise a mix of condensate and refined products.

Kuwait has restored its total refinery capacity to pre-Gulf War levels, about 850,000 b/d. In the 12 months to July 1997 the 20-strong product tanker fleet of the Kuwait Oil Tanker Company (KOTC) carried 10.4mn tonnes of products refined in Kuwait, or 55% of the liftings of the entire KOTC fleet. The primary destinations for these Kuwaiti products exports are Japan, Singapore and South Korea, and shipments of large parcels of naphtha figure prominently in this trade. The KOTC product tanker fleet includes *Kazimah* and *Al Funtas*, at 294,700 dwt the largest product tankers in the world, and a pair of 121,100 tonners. All four ships are well-suited to the carriage of naphtha.

Size range (dwt)	No of ships	Total (dwt) (mn)	Average age (years)	No of ships on order	% of fleet controlled by top 10 owners
10–25,000	406	6.82	17.53	60	33
25–45,000	744	25.49	15.98	44	18
45–60,000	164	8.06	11.14	43	39
60,000+	132	10.03	10.20	2	44

Source: Drewry Shipping Consultants

World Deepsea Product Tanker Fleet (Ships of 10,000 dwt and above, as of April 1997)

Country/region	Imports		Exports	
	1994	1996	1994	1996
US	91.0	92.0	40.1	42.2
Canada	7.1	6.8	14.1	17.6
Mexico	8.5	8.3	4.3	5.1
South /Central America	10.5	15.8	48.6	45.6
Western Europe	82.4	83.1	35.0	36.2
FSU and Central Europe	9.6	12.6	33.7	55.9
Middle East	2.4	3.7	99.7	111.0
North Africa	5.1	5.2	30.2	31.7
West Africa	5.5	6.5	2.5	2.7
East and South Africa	4.2	4.0	0.2	–
Australasia	2.7	3.8	5.0	4.7
China	14.4	15.8	2.7	3.3
Japan	45.2	55.5	6.6	6.2
Other Asia Pacific	59.7	94.4	1.6	49.6
Unidentified	6.0	23.0	19.7	18.7
Total World	**378.0**	**430.5**	**378.0**	**430.5**

Source: BP Review, 1997

Petroleum Product Imports and Exports, 1994 and 1996 (mn tonnes)

Japan, the largest importer of refined products in Asia, deregulated its petroleum product market in March 1996. Prior to that date domestic consumers, and refineries, were protected by limits on refined product import and export levels. Deregulation prompted rationalization and strategic alliances among the country's product importers. However, lack of access to storage and distribution facilities has, to a certain extent, limited the expected surge in Japanese imports. Japanese refiners, anxious to protect their own interests, have been reluctant to rent out their own terminal space to assist product importers, and imports for 1997 to date have been running at levels 10% below those of last year.

South Korea has also deregulated its oil market and the effects are being felt throughout Asia. Several new, worldscale refineries have been completed in Korea in recent years, boosting nameplate capacity to 125mn t/y of products. In 1996 refinery capacity increased by one-third, making significant volumes available for export. The country has already begun shipping significant volumes of products to Japan, China, Hong Kong, Thailand and even the US. Within a year Korea will have an additional 2.5mn tonnes of petrol and 2mn tonnes of gas oil available for export as further new refinery capacity comes onstream.

Chinese imports

South Korea has captured 50% of the Chinese market for imports of refined products, which has been increasing rapidly this year. Spurred by a growing demand for diesel and fuel oil in the northern and south-central parts of the country, Chinese product imports now run at 400,000 b/d, or about 55% ahead of the average for 1996.

Future shipping demand

In general terms, the demand for product tanker transport is expected to continue to build slowly and steadily over the next few years. Precise projections are difficult to make due to the increasing influence of arbitrage trade which is carried out in order to take advantage of seasonal fluctuations and price differentials.

The gains in the volume of products moved by sea and confidence in the product tanker sector have been mirrored, in more recent years, by a steady, growth in ships' earnings. Last year was the fourth year running that earnings increased. A new report by Drewry Shipping Consultants, entitled *Product Tankers: Will Demand Keep Pace with Supply?*, predicts that the time charter equivalent rates of $15,000 per day recorded for a 45,000 dwt tanker during the first quarter of 1997 will increase to a peak of $17,000 in 1999 before falling away slowly down to $14,900 by 2001. These rates should be sufficient to finance a $31mn newbuilding and provide a 10% return on the investment.

Strong time charter rates have driven up the value of modern, second-hand ships and the prices being obtained are approaching those of a newbuilding. One reason for this has been the fact that newbuilding prices themselves have come under pressure due to increased shipyard capacity and weakening currencies in the traditional shipbuilding nations of Japan and Korea. In 1991 a 45,000 dwt tanker cost $45m.

Future trading conditions will be determined primarily by ship supply. The pace of product tanker ordering has picked up over the past 12 months, raising the spectre of overtonnaging. At the end of April 1997, against the current total product tanker fleet of 1,446 ships of 10,000 dwt and above, totalling approximately 53.3mn tonnes dwt, there were 149 ships on order. Although this is not a particularly heavy orderbook, the 43 ships of 45,000–60,000 dwt on order represent one-quarter of the existing fleet in this size range.

The need to scrap older ships will help to reduce the risk of oversupply. By January 2001 about 560 product tankers built in the boom years of 1973 to 1981 will be over 20 years old. Thus, within four years approximately 40% of the current product tanker fleet will have entered the 'very old' age category and become potential fodder for the scrapyards.

Clouds on the horizon

Characterized by a large number of participants with relatively small fleets, the product tanker market has traditionally been among the most competitive in shipping. Although freight rates are expected to improve through to the end of the century, thereafter they are forecast to go into a period of decline. Faced by decreasing revenues and rising operating costs as the new millennium begins, shipowners will find that the timing of their investment and divestment decisions is likely to be just as important to their long-term viability as operating skills.

The 39,500 dwt *Primar* operates East of Suez

Tanker safety: time to shore up first line of defence

Whenever a tanker goes aground or collides with another ship and spills oil, one question always arises: 'Would the spillage have occurred if the tanker had a double hull?' This hypothetical question was raised by the media after the *Sea Empress* went aground outside the South Wales port of Milford Haven and spilt 70,000 tonnes of crude oil in February 1996; following the *Nissos Amorgos* incident in which the 90,000 dwt tanker lost crude through tears in her hull plating after grounding in Venezuela's Maracaibo Channel in February 1997; and when the laden very large crude carrier (VLCC) *Diamond Grace* scraped the bottom of Tokyo Bay in July 1997, writes *Mike Corkhill*.

The three ships, all of which have single hulls, are among the more notable tanker accidents of the past two years. Because the spills were either large in their own right or, in the case of the *Diamond Grace*, had the potential to be, the double-hull question was the subject of considerable debate in all three incidents. Following the Tokyo Bay grounding, the Japanese government went so far as to make a submission to the International Maritime Organization (IMO) recommending that the agreed timetable for the transition to double hulled tankers be accelerated.

Red herring?

For tanker owners and operators, the question of double hulls is a defunct issue. According to the 1992 amendments to IMO's 1973/78 Marine Pollution (Marpol) Convention, new tankers of 5,000 dwt and above must either be fitted with double hulls or built to a design which affords an equivalent measure of protection from a pollution prevention viewpoint. In practical terms viable alternative designs are not currently available and all 600-plus tankers built since the introduction of the 1992 amendments have double hulls.

These Marpol amendments also cover existing crude oil tankers of 20,000 dwt and above and existing product carriers of 30,000 dwt and above. Recognizing that it is impractical to require double hull retrofits for the vast fleet of existing single hull tankers, the Convention seeks to implement more rigorous standards for such ships in other ways. For example, it calls for an enhanced programme of inspections, especially for tankers over five years old. Existing single hull tankers can remain in service until 25 years of age, at which time they will have to be provided with protectively located segregated ballast tanks or utilize hydrostatically balanced loading to remain employed in the oil trades. At 30 years of age they will have to be either fitted with double hulls or removed from service. These Marpol requirements for existing and new ships were debated and agreed early in the 1990s, and are now on the statute books of most maritime nations.

Double hulls are regarded by owners as a matter which has been settled and a 'red herring' that detracts attention from the real issues and the many measures which could be implemented, at considerably less cost than retrofitting double hulls on an accelerated timetable, to improve tanker safety and prevent pollution. The lessons from the three tanker spills, outlined above, help to identify other measures to improve tanker safety in the short term.

The focus on the tankers' structural layout, effectively the second line of defence in the battle against oil pollution, deflected attention from the root causes of the three accidents. In all three cases the groundings could be traced back to the navigational safety issue.

Coastal and port zones represent the most hazardous area of operation for tankers. The historical record shows that of the 20 largest oil tanker spills over the last 30 years, all but five occurred within sight of land. When a tanker approaches land, the master must depend on people and services outside his direct control, notably port authorities, pilots, traffic routeing schemes, tug services, hydrographers and terminal operators, for safe passage.

The UK government's investigation of the *Sea Empress* spill found that the immediate cause of the tanker's grounding was pilot error. In particular, the pilot failed to take effective and appropriate action to keep the tanker in the deepest part of the channel as she approached Milford Haven.

Inadequate training

The official report states that the pilot's error was due in part to inadequate training and experience in the pilotage of large tankers. The pilot and the tanker's master had not discussed and agreed a pilotage passage plan prior to commencing the port approach. As a result, neither the master nor the chief officer knew what the pilot's intentions were. Among its many recommendations, the report states that UK authorities should agree national minimum standards for the training and examination of pilots, and that pilots and masters should agree a pilotage plan in advance of a passage and communicate this plan to the port radar operator.

This lack of a unifying training standard for pilots in the UK is mirrored

'Environment-friendly' tankers certified under the Green Award scheme are eligible for reductions in port dues and service fees from the sponsoring organizations

elsewhere in the world and other maritime administrations have taken heed of the expensive lesson learned at the South Wales port.

The International Association of Independent Tanker Owners (Intertanko) is leading an IMO correspondence group looking into the issue of pilotage passage plans (PPPs) and the period available for submissions is now drawing to a close. The intention is to prepare a PPP format that is non-mandatory and that reflects a two-way flow of information – from the pilot to the ship and from the ship to the pilot. This PPP can be used by both the master and pilot to exchange information ahead of the pilotage passage so that both parties are better informed and prepared.

IMO intends to review the training, certification and operations of pilots beginning in 1998. One option will be to revise Resolution A.485(XII) 'Training, Qualifications and Operational Procedures for Maritime Pilots other than Deep Sea Pilots' adopted by IMO in 1981 and to make the new, stricter requirements mandatory.

Waterway housekeeping

The issue of waterway maintenance was highlighted by *Nissos Amorgos*, one of three tankers to go aground in the Maracaibo Channel within a period of six weeks earlier this year. The ship's master, although held to be liable by the Venezuelan authorities for the spillage of oil from the tanker, claimed that his ship had struck a submerged object. Local pilots are known to be uneasy about the state of some parts of the Channel which is prone to silting and which has not undergone major dredging in many years.

The Venezuelan Navy carried out a survey of the waterway subsequent to the three grounding incidents. Preliminary, unofficial findings point to alleged underwater bank collapses in the Channel as well as the presence of widespread silting and a number of large 'metallic objects' on the bed of the waterway.

The official verdict on the grounding of the laden 260,000 dwt *Diamond Grace* in Tokyo Bay, after apparently veering out of the prescribed sealane and into a shallow part of the bay, is not yet in. However, from reports to date, it appears that the grounding was due to a combination of pilot error and an inadequate vessel traffic separation system. A navigation safety committee appointed by NYK, the ship's owner, has recommended that pilots and tanker masters agree a passage plan prior to transiting the waterway; that additional navigational aid equipment be introduced; and that a bridge resource management training programme be implemented for their ships. The Japanese government has requested that the official accident investigation be conducted on a fast-track basis and the results made available by the end of the year.

The relatively mature, global and dynamic regulatory regime dealing with tanker shipping is not matched by that governing the responsibilities of shoreside authorities charged with the safe navigation and handling of shipping. This situation is reflected in the historical record of tanker accidents and reinforced by many of the more recent incidents.

Safe shipping?

It is important, if a more equitable sharing of the responsibility for ensuring safe shipping is to be achieved, for the entire maritime community to come together without delay to work on a united front. Ultimately, safety will be dependent on cooperation between the tanker industry, other shipping and trade organizations and the responsible shoreside agencies.

Incidentally, the Japanese submission to IMO prompted by *Diamond Grace*, which encouraged member states to press for a quicker phase-out of single hull tankers than had previously been agreed, received short shrift at a recent IMO meeting. The tanker community realizes that its time can be much more productively spent shoring up the first line of defence against tanker accidents.

As one industry observer succinctly put it: 'Single hulls don't cause accidents, and double hulls don't prevent them.'

Japan moves to diversify its resource base

Japan has virtually no indigenous hydrocarbon resources and is reliant on imports to supply almost 99% of its energy needs. Despite major efforts to reduce the country's dependence on crude oil imports following the first oil crisis in 1973, over half its primary energy requirement is still met by oil. The country has continued to diversify its energy balance in recent years – LNG imports are increasing and nuclear power generation is to be further expanded. Petroleum stockpiling is also playing a key role in the country's bid to become less reliant on imports, writes *Kim Jackson*.

Japan is a major importer of oil and gas. In 1996 its primary energy consumption stood at 501.8mn toe, accounting for some 22% of the Asia-Pacific region's total primary energy demand and 6% of world demand. Some 53.77% of this energy requirement was met by crude oil imports, coal accounting for a further 17.6%, nuclear power 15.3%, natural gas 11.86% and hydroelectricity 1.47%.

The lion's share of Japan's crude oil imports, just under 80%, comes from the Middle East. As a result, Japan's energy supply system is somewhat 'fragile' (the influence of changing political conditions in this region was only too clearly evidenced by the shortages created in the first oil crisis in 1973 and those following the Gulf War in 1991).

Despite great efforts to diversify the balance of the country's energy supplies and reduce its reliance on crude oil sourced from the Middle East, the percentage of oil imports has only dropped by 2.2% since 1976.

According to the Japanese Ministry of International Trade and Industry (MITI), approximately 77.3% of the 4.5mn b/d of crude imported by Japan in 1996 came from the Middle East – 27.3% of total crude imports was supplied by the United Arab Emirates and 20.4% by Saudi Arabia. Of the remaining 22.7% of total crude imports, Indonesia was the biggest supplier at 6.6% followed by China at 4.9%.

Altering the balance

As can be seen from **Table 1**, Japan's energy supply balance is beginning to change. Alternative forms of 'cleaner' energy (nuclear, natural gas and hydroelectricity) are forecast to meet an increasing proportion of the country's total energy demand with oil and coal supplying less, dropping by 16.9% and 6.1% respectively between 1994 and 2010. Oil imports will continue to play a key role in the country's energy balance, however, and are expected to still be supplying some 47.4% of the Japan's total energy demand in 2010.

According to MITI's predictions, nuclear power will supply some 16.9% of Japan's energy demand in 2010 – a massive 49.6% increase over the level recorded in 1994. This rise will be dependent on the Japanese Government successfully proceeding with its planned nuclear power generation expansion programme in the face of growing public dissent in recent years.

The number of new hydroelectricity projects in Japan is also set to rise significantly – by some 27.6% in the period 1994 to 2010. However, hydroelectricity will still only account for a small proportion of the country's total energy supply – just 3.7% at the close of this period.

Natural gas is forecast to meet some 12.8% of Japan's demand for energy in 2010, an increase of 18.5% in the period 1994 to 2010. The country first embarked on a programme of promoting the use of natural gas in the late 1970s following the oil crisis in 1973.

Not only was it keen to reduce its reliance on one form of fuel, but Japan also wanted to move away from sourcing the majority of its energy from the politically volatile Middle East.

Japan imported some 63.8bn cm of natural gas in 1996, of which 40% was sourced from Indonesia. Malaysia supplied a further 20%, Australia 15.7%, Myanmar 12.1%, UAE 9.4% and the US 2.8%.

The bulk of natural gas imports, about 72%, is used for power generation according to a recent report from UK analysts Marketline. The bulk of this is used in gas-fired cogeneration plants although cryogenic power generation (whereby electric power is produced by tapping the

unit %

	1960	1965	1970	1973	1979	1985	1990	1994	2000	2010
Oil	37.6	59.6	71.9	77.4	71.5	56.3	58.3	57.4	52.9	47.7
Coal	41.2	27.0	19.9	15.5	13.8	19.4	16.6	16.4	16.4	15.4
Natural Gas	0.9	1.2	1.2	1.5	5.2	9.4	10.1	10.8	12.9	12.8
Nuclear	–	0	0.3	0.6	3.9	8.9	9.4	11.3	12.3	16.9
Hydro	15.7	10.6	5.6	4.1	4.6	4.7	4.2	2.9	3.4	3.7
Geothermal	–	–	0	0	0.1	0.1	0.1	0.1	0.2	0.6
New Energy etc	4.6	1.5	1.0	0.9	1.0	1.2	1.3	1.1	2.0	3.0

Table 1: Breakdown of Japan's Total Primary Energy Supply *Source: MITI*

expansion energy created when LNG or a low-temperature liquid undergoing heat transfer with LNG is transformed into its gaseous state at room temperature) is becoming increasingly important. The growth of Japan's 'environment friendly' natural gas vehicle fleet is also expected to play an important role in developing the country's gas market.

According to Japan National Oil Corporation (JNOC), natural gas supplies are contracted well into the future – enough to supply Japan's energy demands to 2005. Projections are that some 53mn tonnes will be imported in 2005, a figure expected to rise to 58mn tonnes by 2010.

There is no established gas pipeline infrastructure in Japan. All gas is imported via tanker and is then distributed in the cities by town gas companies. Gas is thus a costly commodity as transport costs are high and there is no competition between the town gas companies to keep prices down.

However, there are plans to construct a major north-south gas pipeline across the country, tied to the development of Sakhalin Island resources, which would drastically cut costs for the consumer. Japanese gas consumption could well surge at this point. It is important to note that the potential gas market in Japan is huge as the projected target of 12.8% of total energy supplies being met by gas by 2010 will still be low by world standards. For example, at present around 25% of western Europe's demand and 50% of Russian and Dutch energy requirements are met by gas.

As already indicated, Japan is striving to reduce its reliance on oil imports from the politically volatile Middle East. Sakhalin, Eastern Siberia and the Caspian region are expected to become key suppliers in the future, although much will depend on the progress of related pipeline networks.

The prospect of an East Siberian line linking Russia's Irkutsk region to Japan via Mongolia, China and South Korea, for example, had been significantly hampered by both political and capital investment problems. Although China and Russia signed a gas pipeline agreement last month, the project is still a long way from reality and it may be 2010 before such a pipeline comes onstream.

In a bid to promote the development of an international gas pipeline network, some 30 Japanese finance, trade, energy, steel and heavy machinery industries recently inaugurated the Asia Pipeline Research Society of Japan (APRSJ) – a spin-off from the Wide-Area Natural Gas Pipeline Research Society. The new think-tank will gather relative information and develop basic strategies and proposals to support the economic development of an Asia-wide gas pipeline network.

Country/Region	Japanese company (%int.)	Area	Licensees (%int.)
Australia	SODEC Australia (20%)	Timor Sea AC/P16	Woodside Oil* (40%), Shell (40%)
	Cosmo Oil (25%)	Timor Sea AC/P17	Cultus*(25%), Crusader Resources (25%), PanCanadian Petroleum (25%)
	Idemitsu Oil Expl. (50%)	block WA-263-P	WMC Resources* (50%)
	Idemitsu Oil Expl. (33.33%)	block WA-264-P	WNC Resources* (33.33%), Santos (33.33%)
	Japex Carnabon (20%)	blocks WA-252-P/WA-255-P	Woodside Oil* (40%), Shell (40%)
Azerbaijan	Itochu Oil Expl. (3.92%)	ACG blocks	AIOC*: BP (17.12%), Amoco (17.01%), Lukoil (10%), Unocal (10.05%), TPAO (6.75%) Exxon (8%), Pennzoil (4.82%), Ramco (2.08%), Delta (1.68%), Socar (10%), Statoil (8.56%)
Colombia	Teikoku Oil Colombia (50%)	San Lope block	Ecopetrol* (50%)
Egypt	EPEDECO Suez (40%)	West Ashrafi block	IEOC* (60%)
	EPEDECO Sallum* (100%)	W. Desert, Sallum block	
Gulf of Mexico	Nippon Oil Expl.* (40%)	Vermillion 336 block	Sante Fe Energy Resources (20%), Mariner Energy (20%), Samedan Oil (20%)
Kazakhstan	Jap/Kazak/Pet. (12.5%)	Tulpar block	Mobil* (25%), Shell (12.5%), Aktyubinskneft (25%), Potsk (12.5%), Tulpar (12.5%)
North Sea	Nippon Oil Expl. (15%)	block 30/19a	Kerr McGee* (35%), Shell (12.5%), Fina (12.5%), Esso (12.5%), Wintershall (12.5%)
Oman	Summit Oman Pet. Devt. (32%)	block 33	Elf* (48%), Wintershall (20%)
	Japan Montasar* (100%)	block 35	
Papua New Guinea	Murray Petroleum (25%)	block PPL190	Total ABK* (75%)
Red Sea	Inpex ABK (25%)	Abu Al Bukhoosh (ABK) block	Total* (75%)
Venezuela	Nippon Oil Expl. (20%)	La Ceiba block	Mobil* (50%), Veba Oel (30%)

Table 2: E&P projects in which Japanese companies became involved in 1996

Boosting owned imports

Japan is also endeavouring to increase the level of Japanese-produced crude imports. In 1996, some 67,000 b/d of imported crude was produced by Japanese companies, accounting for just 14.5% of total crude imports. Japan plans to increase this figure to 33% (1.2mn b/d) by 2000. This may be a somewhat ambitious target as the country has struggled to achieve the current 14.5% level.

At present, Japan is involved in some 100 oil and gas exploration and production projects around the globe, including 17 new licensing arrangements announced in 1996 (**Table 2**).

Not surprisingly, attention has focused on the Asia-Pacific region to date with about 33% of today's projects located in this region. Japan is also currently involved in 13 Australian projects, 13 in the Middle East, 12 in the North Sea, 9 in Africa, 8 in North America and 6 in South America. However, future attention is expected to focus on new developing regions such as the Caspian. Japan first entered this region last year by joining the AIOC-operated Chirag-Guneshli field development partnership.

Stockpiling strategy

As Japan has virtually no indigenous resources, stockpiling has, and continues to play a key role in the country's energy system.

Petroleum stockpiling takes two forms in Japan:

(1) private sector stockpiling maintained by private petroleum companies Niigata Joint Oil Stockpiling Co Ltd and Hokkaido Joint Oil Stockpiling Co Ltd, and

(2) government stockpiles held in 10 national oil storage bases which are maintained by JNOC.

At the end of March 1996, government stockpiles stood at about 47.5mn kilolitres (about 76 days' supply) with approximately 74 days' supply, 44.4mn kilolitres, held in private sector stockpiles. The target is to increase government stockpiles to 50mn kilolitres, while private sector levels will be maintained at approximately 70 days' supply.

There are also plans to build up Japan's stockpiles of LPG to 1.5mn tonnes by 2010. At present, these supplies – equivalent to 88 days' supply – are held in the private sector. It is proposed that by 2010 some 50 days' worth of supply be held by this sector with the remaining 38 days held by the government.

Investing in Iranian oil production

The decision by a French-led consortium to sign a $2bn oil development deal with Iran represents the largest single investment in the Islamic Republic since its revolution of 1978/79. Despite the threat of US sanctions on investors, Iran is on the threshold of a major revitalization of its hydrocarbon industries, reports *Colin Barraclough*.

The French-led international consortium which, in late September, defied US sanctions by signing a long-awaited gas development contract, knew its announcement would be greeted with astonishment. After all, France's Total together with Russia's Gazprom and Malaysia's Petronas, were sealing the biggest foreign investment agreement in Iran since the 1978/79 revolution.

Under the terms of the five-year deal covering phases two and three of Iran's offshore South Pars gas development, Total will install, mechanically complete and commission all facilities necessary to support a gas output rate of 2bn cf/d. First production is planned for June 2001 at an initial rate of 500mn cf/d, rising to 1bn cf/d in September 2001.

But more importantly for Iran, the deal represents the first major award involving 12 offshore oil and gas projects valued at some US$6bn announced in November 1995. Iran intends to use the Total deal as a model to secure sufficient investment to revamp its hydrocarbons production, switching its emphasis from onshore to offshore production. If successful, sustainable output could approach 4.2mn b/d by 2000, an output level not seen since 1978.

Oil is the key to the Iranian economy and will remain so in the medium term, despite plans to diversify both within the hydrocarbons sector and outside. The government's strategy – established by former President Ali Akbar Rafsanjani and continued by his successor, Mohammed Khatemi – is to consolidate Iran's current position as the largest producer in Opec after Saudi Arabia by raising national production capacity, and to increase the added value of hydrocarbon exports.

Iran's 90bn barrels of proven reserves comprise 8.8% of total world reserves, sufficient for 71 years of production at present output rates, although oil ministry officials say that unexplored fields in the Caspian Sea could add as much as 50bn additional barrels to the total. Upstream production is controlled by the oil ministry through the wholly owned National Iranian Oil Company (NIOC), which produces 87% of its oil from onshore fields. The National Refining and Distribution Company (NRDC) controls refining, pipeline distribution, engineering, construction and research. The main fields – Gachsaran, Bibi Hakimeh, Ahwaz and the Agha Jari/Karanj/Marun/Parsi complex – are relatively old and have been exploited to maximum capacity during the past two decades.

Iran's Opec quota limits production to 3.6mn b/d, of which 2.6mn b/d may be exported. For some years, Tehran has campaigned to raise its Opec ceiling, but it has also sought a 1.4mn b/d reduction in overall Opec output to boost prices. Given the current surge in non-Opec production, the cartel is unlikely to change the quotas at least until mid-1998.

Internal constraints

Iran's existing oil output is constrained by the age of its main onshore fields. Ageing reservoirs and poor maintenance have led to a drop in output over the past three years. In 1997, Mohsen Yahyavi, Deputy Chairman of the parliamentary oil committee, said that Iran produced 80,000 b/d less than its Opec quota in the Iranian year 1995/96. Unless improvements were made, he said, Iran would be forced to further reduce production to 110,000 b/d below its quota.

At the same time, high levels of domestic demand for petroleum products, spurred by subsidized prices and extensive smuggling, have alarmed the government (**Table 1**). Ex-oil minister Gholamreza Aghazadeh warned that current demand increases of 6% a year will result in Iran ceasing to be a net oil exporter by 2018.

This is clearly a worst-case forecast, but the government's room for manoeuvre on domestic pricing is limited. The parliament has repeatedly rejected oil ministry requests for a one-off five-fold price rise, preferring a graduated rise spread over five years. Accordingly, domestic fuel prices have increased by 130% over the past two years and rose again by 23% in April 1997.

Demand appears to be highly elastic: in December 1996, Aghazadeh said consumption had fallen by 100,000 b/d to about 1.1mn b/d during 1995/96. Nevertheless, with a litre of automobile-grade petrol still costing only IR160 (5.3 US cents) at the pumps, the fuel price remains only one-eighth of the world average and domestic consumption will remain a major concern for the government.

External constraints

The main external impediment to the development of Iran's oil industry is the US desire to limit Iran's financial and political power. The US government has imposed progressively more severe restrictions against Iran since 1987, largely by targeting Iran's oil industry, the Tehran government's major foreign-exchange earner. Its methods have included a complete trade and investment ban on Iran passed in May 1995 and the August 1996 secondary boycott of foreign firms investing more than $40mn in Iran's oil and gas sectors.

However, despite the ferocious attitude of US politicians to Iran's oil expansion plans before the November 1996 US presidential election, the US government took six months to release guidelines to its secondary sanctions legislation. Indeed, the vagueness of the guidelines on their eventual publication reinforced signs that the Clinton administration favours a lenient line.

US officials have interpreted the guidelines as allowing projects underway before the bill became law to award subcontracts and to bring in new partners without incurring sanctions. But there was only muted reaction to energy deals involving Turkey and Malaysia which were signed after August 1996.

Indeed, uncertainty surrounding Washington's interpretation of its own legislation has complicated the oil industry's reaction to the sanctions. Companies such as Total, which signed a $600mn contract to extract oil and residual gas from the Sirri A and E fields offshore in the Gulf in July 1995, continued to negotiate with the NIOC. Petronas, which bought into a 30% stake of the Sirri project in 1996, and Gazprom, also felt confident enough to pursue their interests in Iran.

Majors still involved in negotiations have concentrated on the 40,000 b/d Balal field (valued at $120mn), together

Year	Oil prodn. mn b/d	Oil compt. mn b/d	Gas prodn. bn cm	Gas compt. bn cm
1987	2,330	890	16.0	14.4
1988	2,335	775	20.0	18.0
1989	2,870	880	22.2	20.0
1990	3,255	950	23.2	20.4
1991	3,500	995	25.8	20.5
1992	3,525	1,015	25.0	22.5
1993	3,700	1,060	27.1	23.9
1994	3,710	1,115	31.8	28.6
1995	3,715	1,220	35.1	31.5
1996	3,715	1,170	38.1	34.3

Source: BP Statistical Review 1997

Table 1: Iranian Oil and Gas Production and Consumption

with Soroush, a 90,000 b/d field (valued at $200mn) and the South Pars and Salman gas field developments.

Some countries, including Canada and European Union member states, have enacted legislation countering the US extra-territorial laws. While the South Pars contract seems blatantly to fly in the face of US sanctions legislation, consortium leader Total decided that the US government was showing little interest in following through with its threats.

But many firms with operations in the US are likely to delay contract signatures until methods to circumvent sanctions are more sophisticated. Despite the political backing that Total received from the French government, it sold its remaining interests in the US before signing the South Pars deal. In addition, despite the flexibility shown by the Iranians in the Total buy-back deal, many oil executives express an ingrained reluctance to doing business in Iran.

Flexible marketing

One element of Iran's oil sector which appears to have survived US pressure is marketing. In 1995, the US government banned US-owned firms from buying Iranian oil for re-export. NIOC responded by transporting more crude to end markets, particularly in the Mediterranean. The strategy appears to have succeeded in keeping export flows moving: refiners in Europe and Asia have taken up much of the displaced volume. The bulk of Iran's crude oil exports are now sold to the Far East and Europe, with Japan the largest customer, followed by Italy, the Netherlands and France. Oil export earnings are likely to top $18bn in 1997/98 through the export of 2.5mn b/d.

In addition to its expanded European customer base, Iran has become South Africa's biggest supplier since diplomatic and economic contacts were restored in 1994. NIOC is now responsible for 70% of Pretoria's import market. Ukraine has also stated an intention to buy 20,000 b/d from Iran, which is angling for a commitment four times higher. Iranian oil will be supplied by tanker to a Ukrainian refinery at Odessa.

Central Asian oil swaps

In addition to marketing its own crude, Iran has tried to exploit its geographical location as a conduit to world markets for oil coming from the ex-Soviet republics. Kazakhstan, eager to wean itself off a dependency on existing Russian pipelines, was the first to sign up, agreeing to send shipments of Kazakh blend crude to Iran's Caspian ports in early 1997. The agreement will see 40,000 b/d shipped to Iran's Tabriz and Tehran refineries in exchange for similar quantities of Iranian oil supplied to Kazakhstan's customers calling at Iranian terminals in the Gulf.

Although the crude originates in the Tengiz fields currently being developed for Kazakhstan by Chevron of the US, the oil swap avoids US sanctions legislation. Iran is likely to promote its southern ports as those nearest to Central Asia's oilfields. Despite US objections, it seems only a matter of time before more Central Asian oil reaches the world market through Iran.

However, development of Iran's own hydrocarbon resources in the Caspian Sea remains uncertain. Moscow and Tehran have repeatedly called for the Caspian Sea littoral states to draw up an agreement to share the sea's resources. The Iranian–Russian stand is disputed by the three other littoral states which want jurisdiction over their own individual sectors. However, even the best prospects in Iran's area of the Caspian Sea are less promising than the poorest Gulf fields, meaning that the Iranian government is likely to continue to target development of conventional areas rather than allocating resources for development in the Caspian.

Despite its need for foreign investment and technical know-how, Iran has sought to win production contracts overseas. In 1991, the NIOC won the job of putting out fires at some of Kuwait's oilfields torched by Iraqi occupation troops. In 1995, the company signed a memorandum of understanding with Nigeria for the maintenance of refineries, pipelines and petrochemical plants. More recently, it has offered help to Pakistan, Vietnam and several African and CIS countries with onshore and offshore exploration and refinery construction. Iran also signed an agreement in principle, in early 1997, to build an $800mn oil refinery in Bangladesh.

In its domestic development, foreign participation will be vital if Iran is to maintain its position as the largest oil exporter in Opec after Saudi Arabia. Facing the twin handicaps of ageing onshore reservoirs and limited access to international financial markets, Iran has made the development of offshore oil and gas deposits with the help of foreign investment a key policy. NIOC hopes to double offshore output to 1mn b/d by 2000 from 470,000 b/d, but it may have to abandon some of the offshore projects if foreign firms are reluctant to sign firm agreements in the face of US sanctions.

What the sanctions say:

Under the terms of the Iran–Libya Sanctions Act of 5 August 1996, the US President can impose one or more of the following measures against a sanctioned firm from any third country:

- Denial of US export licenses for any goods or services sold to the sanctioned company.
- Forbidding the US Export-Import Bank to guarantee, insure, extend credit, to participate in the extension of credit in connection with the export of any goods or services to any sanctioned company.
- Barring US financial institutions from making any loans of more than US$10mn in any 12-month period to a sanctioned company.
- Banning foreign financial banks that help finance oil development in Iran from being designated by the Federal Reserve as a 'primary dealer' in US Government debt instruments and from serving as an agent of the US Government or as a repository for US Government funds.

The law allows the US President to waive sanctions on national security grounds or to delay imposing them while trying to convince foreign governments to act against their own companies.

Developments on the up down under

The rapid expansion of oil production from the Carnarvon Basin on the NW Shelf of Australia in recent years has been offset by declining production from the long-established Bass Strait fields offshore southeast Australia. As a result crude import volumes are on the increase. Australia is a major exporter of LNG, however, producing around 36% more gas than its domestic requirement in 1996. *Kim Jackson* looks at some of the latest developments in this region...

Over two-thirds of Australia's primary energy consumption is met by coal and oil. Of the 97.1mn toe of energy consumed in 1996, around 44.09% of demand was supplied by coal, 36.76% by oil, 17.71% by gas and 1.44% by hydroelectricity. The country is totally self-sufficient in coal. It has reserves of some 90,940mn tonnes and produces more than double its annual consumption requirements. Australian oil production, however, covers just 78% of the country's oil needs. Proved reserves of 1.8bn barrels are limited, with an R/P ratio of just 8.5 years, and as a result, crude oil imports have been rising in recent years.

Australia produces far more gas that it consumes and is expected to continue to do so for at least the next decade. In 1996 it produced around 29.8bn cm of gas, consuming just 19.1bn cm. It is a major gas exporter, with some 35% of production leaving the country in the form of LNG. According to UK analysts Marketline, Japan is currently the only country to have an ongoing contract to import Australian LNG. Eight Japanese utilities have long-term contracts for a total of 7mn tonnes per annum (10bn cm/y), a figure that may double after the year 2000. In 1996, Australia also exported some 28,000 tonnes as spot cargoes to Spain, 54,000 tonnes to Turkey and 55,000 tonnes to South Korea.

About half of Australia's gas reserves lie in the Carnarvon Basin on the NW Shelf (**Figure 1**). These reserves will provide the basis for a projected tripling of the country's LNG exports – mainly to Asian markets – during the next eight years to some 25mn tonnes per annum by 2005.

Promising developments

The largest and most significant offshore oil production area in the past has been the Gippsland Basin in the Bass Straits offshore southeast Australia. More recently, however, attention has focused on the Carnarvon Basin and the Timor Sea following a number of major oil and gas discoveries in recent years (**Figures 1,** and **Tables 1** and **2**).

Several major new development projects are planned in this region over the next decade, one of the most important being the A$10bn expansion of the NW Shelf Development Project (NWSDP) which will double LNG production and underpin Australia's rapidly expanding gas export market. The programme includes the likely construction of new LNG processing facilities to handle output from the Gorgon/Chrysaor gas fields together with production from the West Tyral Rock, Perseus and Spar fields.

Carnarvon Basin leads the field

According to analysts Wood Mackenzie, Australian oil/condensate output increased by 4% to 535,000 b/d in 1996, due mainly to the Wanaea/Cossack fields coming onstream in the Carnarvon Basin in December that year. The two fields have 200mn barrels and 33mn barrels of reserves respectively and form part of the NWSDP which has total reserves of crude oil and condensate in excess of 900mn barrels. Wanaea/Cossack will act as a hub for nearby satellite fields such as the Lambert and Hermes fields which will be developed by subsea tie-backs to the *Cossack Pioneer* FPSO.

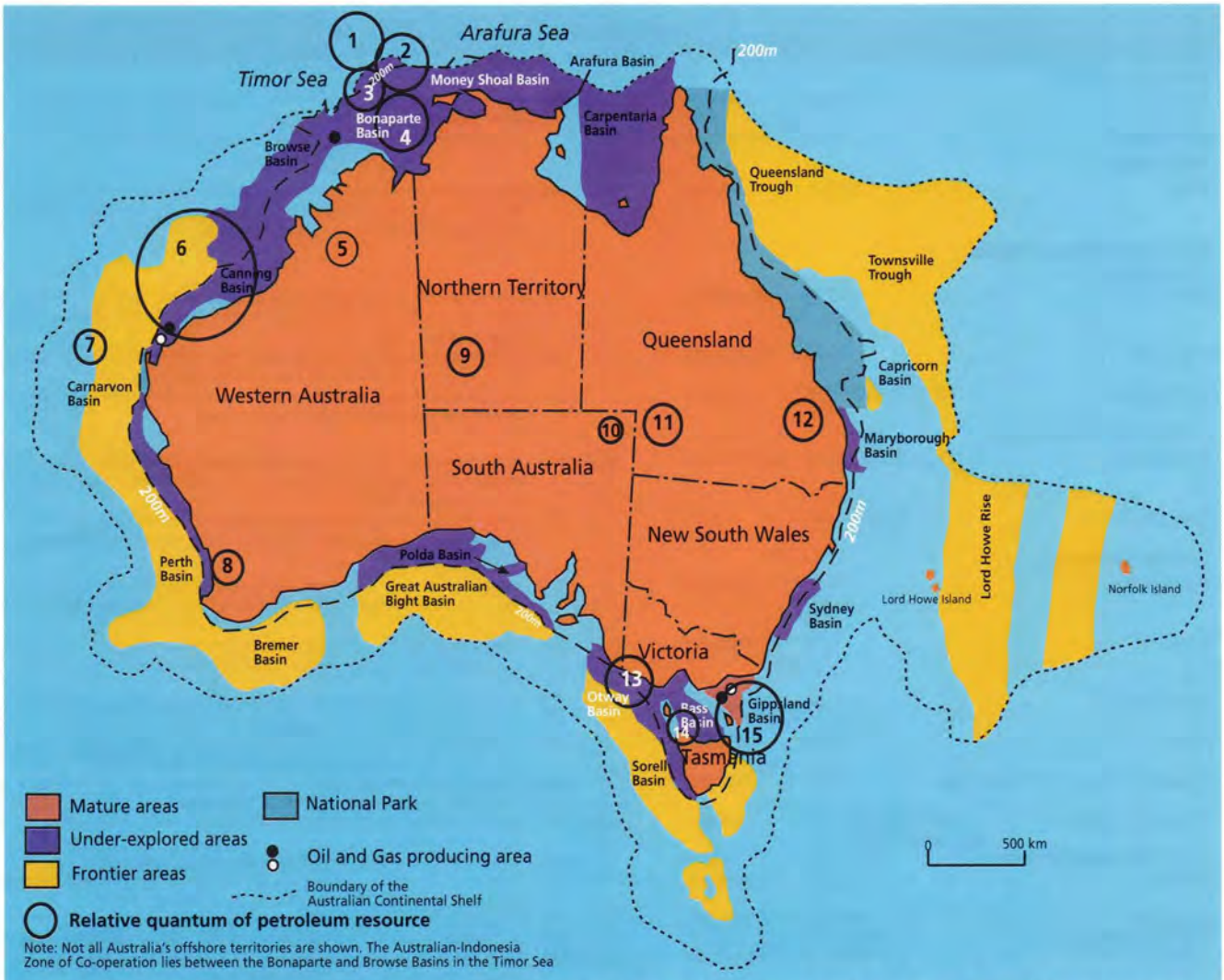
Oil production from the Carnarvon

Seller	Acquirer	Price(A$ mn)	Core assets*	Output	% int.
Ampolex	Mobil	1,780	Gorgon	gas/cond	14.30%
			Kutubu [b]	oil/gas	16.50%
			Aguaragüe [c]	gas/cond	23%
			Wandoo	oil	60%
			Harriet	gas/oil	25%
			East Spar	gas/cond	35%
Parker & Parsley	Santos	200	East Spar	gas/cond	15%
			Cooper Unit	gas/oil	1.6–25%
Crusader	Clyde [a]	178	Cooper Unit	gas/oil	4.80%
Parker & Parsley	Phillips	108	Bayu	gas/cond	22.50%
Discovery	Premier	108	Mount Horner	oil	100%
			Kakap [d]	oil/gas	18.80%
Marubeni Australia	Tap Oil	60	Harriet	gas/oil	12.20%
Western Mining	Shell	40	Thevenard Isl.	oil/gas	10%
Mobil	Apache	425	East Spar	gas/cond	35%
			Harriet	gas/oil	25%
Western Mining	Novus Petrol	n/a	Airlie Isl. Area		40%
			- South Pepper	oil	
			- N Herald	oil	
			- Chervil	oil	
Western Mining	Santos	180	East Spar	gas/cond	30%

* Australian assets unless otherwise stated; [a] Clyde subsequently taken over by Gulf Resources in early 1997; [b] Papua New Guinea; [c] Argentina; [d] Indonesia; n/a: not applicable

Source: Based on Wood Mackenzie's Australasia Report, *January 1997*

Table 1: Australian Independents – Takeovers by Foreign Companies in 1996 and 1997



Area 1 -Laminaria/Corallina, **Area 2** - Elang/Kakatua, Bayu/Undan, **Area 3** - Buffalo, **Area 4** - Petrel/Tern, **Area 5** - Sundown, Blina, **Area 6** - Agincourt, Angel, Bambra, Barrow Island, Cossack, Crest, Dongara/Mondarra/Yardarino, Echo/Yodel, Gorgon/Chrysaor, Griffin/Chinook/Scindian, Hermes, Lambert, Macedon/Pyrenees, Perseus, Saladin, Stag, Wanaea, Wandoo, Wonnich, **Area 7** - Scarborough, **Area 8** - GMT Horner, Woodada, **Area 9** - Mereenie, Palm Valley **Area 10** - Moomba Area **Area 11** - Jackson Area, SWQ Gas Plant, Tintaburra Area, **Area 12** - Roma, **Area 13** - La Bella, Minerva, Port Cambell Gas Project , **Area 14** - Yolla, **Area 15** - Blackback/Terakihi, Bream B, Moonfish, Patricia/Baleen, Turrum, West Tuna

Figure 1: Australian Fields with Development Potential

Basin in 1996 was about 275,000 b/d (compared to 212,000 b/d in 1995), surpassing for the first time output from the Bass Straits which averaged 200,000 b/d. The Carnarvon Basin is now the premier petroleum producing region of Australia, accounting for 51% of the country's total oil/condensate production.

Timor Sea turnaround

Output from the Timor Sea dropped by 30% in 1996 to around 20,000 b/d – reflecting the decline of the existing Jabiru, Challis and Skua FPSO developments and the shut-in of Jabiru for maintenance for a total of around five months over the course of the year. However, the area is set for a significant turnaround over the next few years as a number of new developments come onstream. The first of these will be the relatively small 30mn barrel Elang/Kakatua oil project due to be commissioned in 1998.

Boost to production

Regional production will receive a substantial boost with the commissioning of the Laminaria and Corallina projects in 1999. Estimated to hold 130mn to 250mn barrels of oil reserves, the two fields are expected to account for two-thirds of projected Timor Sea production in the year 2000. Production will be further increased in 2001/2002 when the Bayu/Undan gas/condensate field in Area A of the Timor Gap Zone of Cooperation (ZOCA) comes onstream. The field holds reserves of 350 to 400 mn barrels of oil and between 3.1tn to 3.6tn cf of gas.

Onshore E&P activity continues to be highest in the Cooper/Eromanga Basins in Queensland and South Australia.

As *Petroleum Review* went to press, Santos announced a major gas find in the Barrolka complex in southwest Queensland. Estimated to hold around 130mn boe of reserves, the discovery is claimed to be the largest made in this region over the past 25 years.

Flurry of takeover activity

Both 1996 and 1997 saw an unprecedented volume of corporate and takeover activity of Australian independents by foreign companies. Wood Mackenzie attributes this to a combination of high oil price and a perception that oil and gas assets in this region were undervalued (**Table 1**).

Basin/Field	Permit no.	Operator	Oil or Gas output	Notes
Amadeus Basin				
Mereenie	OLA4,5	Santos	gas	$10–15mn/y drilling programme. $5mn LPG plant to separate LPG. $4mn gas plant upgrade to service new markets.
Palm Valley	OL3	Magellan		Expansion of onshore gas production facilities and gathering system.
Bass Basin				
Yolla	T/RL-1	Boral	oil/gas/cond	Reserves estimated at 300–600bn cf gas, 1mn tonnes LPG, 30mn barrels condensate, 3mn barrels oil. Development – gas platform, separation facilities, subsea pipeline amd onshore processing/storage.
Bonaparte/Browse Basin				
Australia				
Laminaria	AC/P8	Woodside	oil	Four subsea production wells producing 120,000 b/d, tied back to FPSO rated for 170,000 b/d peak capacity with 1.4mn barrels storage. Due onstream March 1999.
Corallina	AC/P8	Woodside	oil	Development integrated with Laminaria FPSO facility. Two subsea production wells producing 50,000 b/d. Due onstream early 1999.
Tern/Petrel	NT/P28, WA-18-P	Santos	gas	Some 56 to 84bn cm of gas reserves. Platform and FPS development options currently being considered. Due onstream in 2000.
Zone of Cooperation				
Bayu/Undan	ZOCA 91-13/91-12	BHP/Phillips	gas/cond	Total recoverable reserves – 350-400mn barrels liquid (Phase 1, liquids recovery plant, Wickham Point, Darwin), 3.1–3.6tn cf gas (Phase 2, LNG). Start-up expected 2001/2.
Elang/Kakatua	ZOCA 91-12	BHP	oil	Leased FPSO and three subsea wells. Start-up expected mid-1998. Reserves – 15mn barrels. Peak production – 33,000 b/d. To be depleted over two years.
Carnarvon Basin				
Agincourt	TL/6	Apache	oil	Development – one horizontal well, monopod platform. Production via 6-km pipeline to Varanus Island. Initial production of 7,000 b/d. Gaslift. Due onstream 3Q 1997.
Bambra	TL/1	Apache	gas	Planned tie-in to Harriet Gas Gathering Project. Smallest of fields to be tied-in to project. Timing dependent on future discoveries and performance of fields.
Barrow Island	L1H	Wapet	oil	Part of four-phase Windalia Reservoir drilling programme for 1995–2000. 25 injectors/producers to be drilled 97/98.
Crest	EP65	Wapet	oil	Greensand Formation to be developed after Flacourt Formation. If testing successful, horizontal wells planned for this interval early in 1998.
Dongara/Mondarra/Yardarino	L1,L2	Wapet	gas	Potential for significant expansion of gas storage project at Mondarra. Future development awaits outcome of sale process.
Chrysaor/Gorgon*	WA-2-P, WA-3-R WA-205-P, WA-253-P	Wapet	gas/cond	Reserves – 6.6tn cf gas, 50mn barrels condensate, 14mn barrels oil. Due onstream in 2000/3.
Griffin/Chinook/Scindian	WA-10-L	BHP	oil/cond	Development completed using FPSO. Additional wells planned for 1997/98.
Hermes	WA-8-R	Woodside	oil	Initial development via single subsea well tied back to *Cossack Pioneer* FPSO. Additional well planned in 1998. Due onstream by end 1997.
Lambert	WA-8-R	Woodside	oil	With Hermes field via subsea wells tied back to to Wanaea/Cossack in 1998.
Macedon/Pyrenees	WA-155-P	BHP	gas	LPG, methanol and gas to Western Australian domestic market opportunities.
Perseus*	WA-1-L	Woodside	gas/cond	Producing via single well on North Rankin A platform. Some 56 to 84bn cm of gas. First phase of development expected in late 1990s.
Saladin	TL/4	Wapet	oil	Production declining from Flacourt Formation wells. Two onshore wells and one offshore well drilled in Mardie B formation in 1996 and 1997.
Spar*		Wapet	gas	Due onstream in 2002.
Stag	WA-209-P	Apache	oil	Some 35–55mn barrels reserves. Five horizontal and three water injection, electric submersible pump assisted wells tied back to 50,000 b/d capacity central processing facility. Peak production – 22,000 b/d. Onstream early 1998.
West Tyral Rocks*		Wapet	gas	Onstream 2002. Reserves – 19mn barrels oil, 21mn barrels condensate, 1.6tn cf gas.
Cooper Basin				
Jackson Area	ATP 259P	Santos	oil	Development wells programme, optimize existing wellbores and expand water treatment. Cost $10 to $15mn per annum.
Moomba Area	PEL5,6	Santos	gas/oil	Ongoing development programme costing some $80 to $90mn per annum. Some 30 to 40 drilling/in-wellbore opportunities per year. Several major field compression installations planned to 2000 at cost of some $60 to $65mn.
SWQ Unit/Ballera		Santos	gas	$200mn expansion of gas plant/gathering system and associated field development. Contracts for 375PJ over 15 years from 1H1998.
Tintaburra Area	ATP 299P, 267P	Santos	oil	Accelerated programme to develop Tarbat/Ipundu oil resource proved up during 1996. Includes construction of $8mn pipeline linking Tarbat into existing Jackson-Moonie pipeline.
Exmouth Plateau				
Scarborough	WA-1-R	Esso/BHP	gas	Some 226bn cm of gas reserves. Production could supply new LNG plant proposed by Esso/BHP.
Gippsland Basin				
Bream B	Vic/L14	Esso	oil	Fixed satellite to Bream A platform, start-up late 1996.
West Tuna	Vic/L4	Esso	oil	Production began early 1997. Development project until 1999.
Surat/Bowen Basins				
Roma/Surat		Santos	gas	Development of reserves to support existing SE Queensland contracts and service new markets.

** Part of A$10bn NW Shelf expansion project which includes construction of new LNG processing facilities to process reserves from Gorgon/Chysaor, West Tyral Rocks, Perseus and Spar fields.*

Sources: Wood Mackenzie - Australasia Report, *January 1997; International Energy Agency* - Global Offshore Oil Prospects to 2000; *Offshore Supplies Office (OSO) – Hydrocarbons Projects Database*

Table 2: Future Development Potential in Australia

REPORT Technical

Health

A contract has been placed with the Occupational Health department of Birmingham University for the archiving of the documents used in the development of the IP epidemiological study of Refinery and Oil Distribution workers. Archiving will commence on completion of the scanning of these documents on to CD-Rom.

The Summary of the Environmental Epidemiology workshop organized by the Occupational and Environmental Medical Subcommittee is being extended to provide a more complete explanation of topics including the strengths and weaknesses of this technique which has an important influence on Standards setting.

Upstream

The IP has continued to provide secretarial support to PSE/17 and its Subcommittees. Secretarial support for the 'Pipeline Transportation Systems' BSI Committee has been taken over by the Institute. The new Subcommittee will be able to benefit from the variety of new processes developed by the Institute in conjunction with PSE/17 and its other Subcommittees.

The IP formed part of the UK delegation at the recent ISO/TC 67 Plenary Meeting in Jakarta. The development of international standards is at a watershed with additional participation essential to delivering the standards which industry will use. The programme of work is seriously behind schedule with no standards published in 1997. Much of the discussion was therefore on the corrective measures that need to be put in place in order to focus resources to publish some 25 key standards in 1998.

The fifth Petroleum Geology Conference of NW Europe and Exhibition which was held at the Barbican Centre in October was opened by the IP President. This was the culmination of nearly two years work by the Organizing Committee in which the Institute participated. This major conference takes place every five years and some 1,300 delegates attended this event making it the most successful to date.

Microbiology

Work has started on the revision of IP 385 Determination of the viable microbial content of fuels and fuel components boiling below 390 °C – Filtration and culture method. It is planned to develop this as an International Standard.

Measurement

The second edition of *Petroleum Measurement Manual, Part VII, Density, Sediment and Water: Section 2: Continuous Density Measurement*, was published in September 1997.

PMM Part III, Manual Measurement of Level in Tanks, Section 1: Non-Electrical Methods, is nearing completion and is expected to be published early 1998.

Aviation

The Hydrant Working Group has been established to steer the 1997 research project investigating the use of pipeline gradient in maintaining the cleanliness of fuel in new hydrant systems. A further project is proposed for 1998 to investigate the capabilities of different flow regimes to clean existing systems.

Publication of the *Airport Safety Code* has been delayed to allow the API time to consider the final draft with a view to developing it instead of updating its current code.

Environment

The *Sector Application Guide for ISO 14001: for the Marketing and Distribution of Petroleum Products* has been published.

Work has also continued on *Guidelines for the Environmental Risk Assessment of Retail Sites*. The Environment Agency has provided information to participants in the trial of the IP Environmental Risk Assessment procedures. Returns and comments will be reviewed 4Q97, prior to publication of new guidelines which are intended for use by service station owners.

A part IP funded research project, 'A Field Evaluation of Bioremediation Strategies for Mudflats', has been completed and the first phase of an IP funded project to develop, 'A Leaching Test for Materials Contaminated with Oils', has also been completed. Copies of the reports are held at the IP.

Refining and Marketing

The document *Access to the Top of Road Tankers* was published in September 1997.

Final resolution and editing of comments for *Guidelines for the Control of Hazards Arising From Static Electricity* is in progress. Publication is expected end-1997/early 1998.

The working group updating the Area Classification Code is considering a proposal from the consultant for amending the present document. This includes the new means of calculating hazard radii for Zone 2.

IP Guidance on pollution prevention in the oil and bulk storage industries is now included in the *Environment Agency Guidance Manual* for its field inspectors.

A working group has been set up to consider wear tolerances for Bottom Loading Equipment.

The two consultative documents on Service Station Regulations and Operational Guidance published by HSE are being reviewed by Institute Committees. The Institute will be circulating, on behalf of the industry a revised Technical Guidance document for final consultation by the end of November. This has already been reviewed by HSE.

Guidance on Model Work Control Procedures has been published as part of the *Code of Safe Practice for Contractors Working on Petrol Filling Stations*.

The trial of the test protocol to establish maximum loading rates for gasoline tankers at terminals without emission of vapour has been completed. Two different types of tanker were tested together with various equipment combinations.

The monitoring of the operation of Stage 1/Stage 2 vapour control equipment at service stations by the Institute has been undertaken. Equipment has been installed at the selected service stations and data has been collected for several weeks.

Test Method Standardization

A very successful, well attended, Workshop on Diesel Fuel Lubricity testing was held at BP Technology Centre. Items addressed included apparatus preparation, humidity/temperature control and test result interpretation. This is the first in a series of IP workshops on specific analytical techniques.

A 'Round Robin' exercise has been carried out to collect data for a precision statement for the determination of water content of petroleum products using both Coulometric and Potentiometric Karl Fischer techniques.

Material for the 1998 edition of the IP's *Standard Methods* has been collected and the book is on schedule for publication in January 1998. Work continues on the production of the Book in a CD format and it is hoped to have a sample CD available early in 1998.

John Hayes
Technical Director

A golden age of petroleum technical training for the services

The army Petroleum Centre at West Moors in Dorset recently invited its 'pi' graduates to a 50th anniversary reunion. *Lt Col Curly Cail (Retd) OBE*, himself a graduate, outlines the Centre's history and reports on what proved to be a most enjoyable get-together...

At the beginning of the Second World War resupply of gasoline and diesel fuels was restricted to container stocks in drums and four-gallon 'flimsies'. But the increased mechanization in modern warfare required that fuels should move in the most economical quantities throughout their journey from the refinery to the fighting vehicle.

To meet this demand, personnel from the oil industries were co-opted into the Services to carry out their peacetime roles under active service conditions, which they did to great effect. However, towards the end of the war it was evident to the professional army staffs that regular officers must be trained to continue and progress the new handling techniques which had been developed. A start was made during the Italian campaign when about a dozen regular officers were given specialist training and assigned to technical petroleum units at the main supply ports on the Mediterranean and Adriatic coasts.

During the course of the war a training centre had been established at the National Oil Refinery (BP) at Llandarcy in South Wales to prepare the peacetime oil professionals for their wartime roles and, on cessation of hostilities and a return to peace, a dialogue commenced between the Ministry of Defence (MOD) and British Petroleum with a view to setting up a technical training course to prepare regular officers for the planning in peacetime of major petroleum facilities at reception ports in a theatre of war and for forward distribution therefrom, as well as the operation of these facilities on the ground.

Back to school

The first course commenced in 1949 with a 'return to school' for 'veteran' regular officers in their thirties, most of whom had just completed four or five years of war service. Some had been involved in the resupply of petroleum in the field while others came from a wide background but with sufficient technical qualifications to assure that they would be able to assimilate the teaching in hydraulics, mechanical engineering, technical drawing, surveying and petroleum chemistry, among the wide range of technologies to be absorbed. In fact the first phase of the course was a return to school, in the form of a refresher course in mathematics, physics and chemistry to ensure that everyone started on a reasonably level playing field.

Initially courses lasted for some 15 months. The last phase of the course was a series of visits to specialist installations and industrial facilities, finishing with a major exercise in which, in syndicates, the course would prepare a complete design for port petroleum installations and a forward pipeline, with full drawings and calculations, including selection of suitable sites, tankage, pumping stations, pump specifications and so on.

IP links

All qualifying students were given the specialist qualification 'Passed Long Petroleum Installations Course – (pi)', and were offered membership of the Institute of Petroleum (IP) which, in the early days, was an Associate Fellowship. For very many years the course has been oriented on the army Petroleum Centre at West Moors in Dorset (although during those years the establishment has changed its name several times and worn three different cap badges!). Today's courses last 10 months and embrace Army, RAF and Commonwealth and foreign officers. The students are required to register as student members of the Institute of Petroleum and receive full membership on graduation.

On retirement only a small number of graduates moved to the petroleum industry and perhaps the industry lost out thereby! Of those who did, however, some memories may be stirred by the names Peter Bainbrigge (PITB – Course 9), Roger Bensaid (Simon Storage – Course 22), Curly Cail (Simon Storage – Course 5), Peter Cooke (PD Storage – Course 7), Gordon Drury (SMBP – Course 8), Marian Randall (Simon Aviation – Course 32) and Peter Whitehead (Associated Octel – Course 5).

Golden get-together

In May this year, in a very appropriate and most welcome gesture, and after almost 50 years during which more than 300 officers graduated from the course – including over 60 from Commonwealth forces and, in later years, some 20 RAF officers – the present Commandant of the Petroleum Centre, himself a graduate of the course, invited past graduates to visit West Moors for a retired 'pi' Officers'

Graduates from the army Petroleum Centre at West Moors in Dorset celebrate 50 years of petroleum technical training for the services

Day on Friday, 29 August 1997.

A major problem was to trace the present whereabouts of potential invitees, many of whom had been long-retired. After painstaking research some 70 invitations were sent out and, of these, about half were able to accept. The earliest was from Course 2 and the most recent from Course 42.

From the moment of arrival retired officers who had not seen each other for 20 or 30 years were plunged into vivid reminiscences of times past, old friends and shared experiences until the party moved to the Lecture Hall where the Commandant gave a most interesting talk covering the history of the Centre from setting up in 1944 of a US packed storage depot for D-Day and hand-over to the British Army at the end of hostilities, through the various changes of role to the present day when, in spite of the run-down of the services, the fuel resupply requirement has expanded to the point where, with overseas commitments such as the Falklands, Gulf War and Bosnia, there is now a shortage of petroleum operators.

After a buffet lunch when the discussion and reminiscing continued, a bus took everyone on a tour of the Centre where current refuelling vehicles and field equipment had been set out to represent the resupply of fuels by sea at a theatre of operations to delivery to service units in the field. Most impressive was the way that young soldiers, NCOs and officers of both sexes described their roles and equipment and how they would be operated. The latest peacetime container-filling equipment meeting the current stringent requirements of UK and European environmental legislation were also shown.

A recent innovation and major economy had been the takeover of the Centre's fire training facilities by the Dorset Fire & Rescue Service which now trains servicemen in all aspects of fire fighting, in addition to its own personnel. It gave very impressive demonstrations of dealing with an oil fire and rescuing a casualty and also its civilian role at major traffic accidents.

So, after a final cup of tea, and thanks to the Commandant and his staff for a most interesting and enjoyable reunion, the 'old and bold' departed, content in the knowledge that the techniques of fuel handling in the forces were well up to speed and in good hands.

IP Week 1998: 16–19 February

The Institute of Petroleum's 'IP Week' in February has become established as a key industry forum which attracts leading oil and gas industry figures to London for an intensive round of conferences, industry events and social functions. The Institute's own programme of events is the core of these activities.

IP Week 1998 will commence on 16 February with an International Conference on **'Oil and Gas after 2000 – Realignment and Restructuring for the New Millennium'.**

The 1990s have proved to be difficult times for the oil industry. World economic progress has been inconsistent, with a long sustained recession in much of the Organisation for Economic Co-operation and Development (OECD), contrasting with spectacular growth in some developing markets. The industry has come under many environmental pressures to develop new and sometimes costly products and processes whilst demand for these products has been patchy and margins were squeezed. Additionally new technologies had to be discovered or invented to economically exploit opportunities.

The industry and its affiliated companies needed to think radically to survive and prosper in this climate. Political change, driven by economic necessity (and fashion) has led to de-monopolization, deregulation and privatization amongst national oil companies. The government of the Russian Federation, CPC of Taiwan, OMV of Austria and Petrobras of Brazil will provide interesting comparisons and contrasts in their approaches on how to tackle these issues.

Oil has always been 'political'. The early 90s was influenced by the Iraqi invasion of Kuwait and the ensuing Gulf War. Several companies are now finding their business objectives potentially conflicting with the ideologies of nation states. Total SA find themselves in conflict with the US Congress and US foreign policy as they seize strategic opportunities in the Persian Gulf.

Throughout the industry, companies have radically altered their approaches to doing business. Partnerships, alliances, joint ventures and mergers have seemed to provide routes to releasing shareholder value, while at the same time imaginative solutions were needed to fund projects and developments. All these factors provided previously-unencountered challenges to management together with fashionable trends in downsizing, restructuring and outsourcing.

As the millennium approaches industry leaders must again reflect on fundamental questions about the future. Where is the oil industry going now? What are the threats to its continued success? Where will the new opportunities lie? What

Photo: courtesy of BP

One of the speakers at the conference will be Peter Sutherland, Chairman of BP and Goldman Sachs International

IP Week 1998 Programme of Events

Monday 16 February

International Conference on Oil and Gas after 2000 – *Realignment and Restructuring for the New Millennium*

Tuesday 17 February

Annual Luncheon
Dorchester Hotel, Park Lane, London
Guest of Honour and Speaker
Dr Mark Moody-Stuart,
Managing Director, Royal Dutch/Shell Group

London Branch Evening Discussion Meeting – *European Auto Oil 2?*

Details not available at time of publication, please contact the Conference Department for further information

Wednesday 18 February

Price Risk Management: *The 11th Oil Price Seminar and Exhibition*

Supported by

New York Mercantile Exchange

Annual Dinner
Grosvenor House Hotel, Park Lane, London

This famous event is the largest in the oil and gas industry calendar and attracts senior industry figures from all over the world. This year's speaker has not yet been announced but in keeping with the Dinner's tradition promises to be a senior figure in the international arena.
Only IP members may apply for tickets. For further information, please contact the Conference Department.

Thursday 19 February

International Conference on *Innovations in Offshore Field Developments*

Chairman and speakers include:
Rex Gaisford (Director of International Development, Amerada Hess International Ltd),
Luiz Eduardo Guimarães Carneiro (E&P Executive Superintendant, Petrobras, Brazil),
Alan Gaynor (Chief Executive, British-Borneo Petroleum Syndicate plc),
Harvey Smith (President, Hibernia Management and Development Company, Canada),
Thor A Tangen (Senior Vice President, Norsk Hydro, Norway) and
Don Vardeman (Manager, Marine Facilities and Engineering, Oryx Energy Company, USA).

All events will be held in London

must it be doing to respond to them?

The ultimate question must be 'Is oil going to run out early in the new millennium?' Or at least, 'will it become so scarce that those $50 per barrel prophets of the early 80s finally justify their pessimism'?

Companies will need to make their own judgements about prospects and decide how they should proceed. There cannot be a uniform industry response. Different cultures, business objectives, political, economic and social constraints frame the policies of individual enterprises. There can be no right or wrong conclusions. However, this International Conference in IP Week will bring together a distinguished group of industry leaders and decision-makers to outline their ideas about the future, and the appropriate direction and strategies for their companies.

Who should attend?

This is an essential event for those people with a long term interest in the industry, in originating policy and developing strategy and, leading opinion. This includes directors and general managers, those responsible for designing the structure and finance of partnerships, alliances and other contractual arrangements and their specialists advisers, together with those charged with managing and operating them. It will be relevant to anyone who is working in this complex new environmnet whether as an operator or supplier of goods and services.

For a copy of the IP Week 1998 Programme and registration form, please contact Pauline Ashby, Conference Administrator, Institute of Petroleum, London W1M 8AR, UK. Tel: +44 (0)171 467 7100 Fax: +44 (0)171 255 1472 or view the IP Web Page: http://www.petroleum.co.uk/petroleum/

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Speakers:

Antonio Carlos S de Agostini (E&P Director, Petrobras Brazil),

Dr F J Chalabi (Executive Director, Centre for Global Energy Studies and Past Deputy Secretary General, OPEC),

Thierry Desmarest (Chairman and CEO, Total SA),

Richard Giordano (Chairman, BG plc),

Robert Mabro CBE (Director, Oxford Institute for Energy Studies),

John Mitchell (Chairman, Energy and the Environment, Royal Institute of International Affairs),

Dr Wenent P Pan (President, Chinese Petroleum Corp, Taiwan),

Dr Richard Schenz (CEO and Chairman of the Executive Board, OMV, Austria)

Peter Sutherland (Chairman, BP plc and Goldman Sachs International).

Automatic sample changer for flashpoint tester

Petrotest Instruments of Dahlewitz, Germany has introduced an automatic 12-test position sample changer for the Pensky Martens PM4 flashpoint tester that it unveiled earlier this year (see *Petroleum Review*, July 1997).

The standard flashpoint tester system includes three cup/lid assemblies, each with its own shutter and stirrer mechanism, allowing three test samples to be prepared in one step.

PM4 flashpoint tester with 12-test position automatic sample changer

A multi-function pivot head automatically connects/disconnects the stirrer, ignitor, flashpoint detector and the temperature probe and enables each sample cup to be simply exchanged with the next sample cup to be tested. Test parameters can be recalled from a built-in database, allowing most flashpoint tests to be conducted with only a few keystrokes.

The sample changer enables up to 12 flashpoint tests to be completed, unattended by the operator. A microprocessor allows the system to operate even when all 12 test positions are not filled. The unit includes Windows® software for PC data transfer while the flashpoint tester features a direct printer port.

The complete arrangement fits under a standard laboratory fume hood, ensuring that the operator is not exposed to noxious fumes.

Tel: +49 33 70 856 300
Fax: +49 33 70 856 555

Zone 0 approval for new tank gauging system

A new high accuracy tank contents gauge – Prolevel – has been introduced by Eurogauge of East Grinstead. The magnetostrictive device measures the distance between a fixed point inside the sensor head and a permanent magnet in a float which travels up and down on a probe in the liquid to be measured. Nominal accuracy is claimed to be 0.02%. Maximum permissible probe length is 3.5 metres.

The unit is certified for use in Zone 0 conditions and has EEx ia IIB T3 PTB approval. The gauge can operate in temperatures of –25°C to 75°C. The EXU-1 unit may be located up to 700 metres from the probe.

Multi-channel amplifier/data processing units can be supplied for multiple tank installations, states the manufacturer.

Tel: +44 (0)1342 323641
Fax: 44 (0)1342 315513

Tank blanket valve has high and low pressures covered

Anderson Greenwood's new BV-1 single valve system is capable of handling pressures from 15 psig to 200 psig. The unit features a pilot valve mounted directly in the main valve body, resulting in fewer components and making it both compact and easy to install and maintain, says the manufacturer. An internal filter on the inlet captures any particles in the stream, eliminating the need for separate filter systems.

Manufactured from stainless steel and fitted with chemically resistant Teflon diaphragms and fluorosilicone seals, the valve can be easily converted for internal self-purging which prevents corrosive vapours entering and corroding the unit.

Tel: +44 (0)161 494 5363
Fax: +44 (0)161 494 5672

Kind clean up for skin

Derma Shield, a skin protectant which is said to reduce clean up time by up to 90%, leave skin cleaner than with traditional methods and improve skin condition, is currently being tested on 10 offshore platforms in the North Sea and in a diving subsea environment.

Manufacturer Benchmark Technology states that Derma Shield is more than a pre-work or after-work cream and should not be thought of as just a barrier cream. 'It is a skin protectant agent which helps the skin's natural defenses without affecting its intrinsic ability to breath and perspire,' says the company. 'It won't wash off, won't dry the skin out and won't leave the skin stripped of its natural oil at the end of the day. Sense of touch is not affected and Derma Shield does not feel greasy when applied.'

The manufacturer is offering a full money-back guarantee to all new customers if they are not satisfied with the product.

Readers of *Petroleum Review* may obtain a free sample of Derma Shield by calling Stan Allen of Heath Technical Services on +44 (0)181 653 4648.

Benchmark Technologies
Tel: +44 (0)1633 877569
Fax: +44 (0)1633 865282

Upgraded oil grabber unveiled

The Abanaki Oil Grabber® Model 4 has been redesigned to offer improved oil removal. Now available with belts made of fibre-reinforced plastic that can handle oil temperatures up to 100°C, the device also features wider, deeper troughs that allow it to handle an increased volume of viscous oil.

The oil grabber has also been modified to simplify maintenance and cleaning. A steel mesh guard allows visual inspection of the drive pulley. The guard has no screws and can be simply pulled away allowing the operator to change the belt without any tooling.

Developed for use in a variety of applications, such as wastewater sumps, coolant systems and underground tanks, the Model 4 oil grabber removes oil from water and water-based solutions at a rate of up to 76 l/h. Depending on the liquid, the device is said to be capable of reducing oil content to less than five parts per million in water.

The oil grabber operates by using the differences in specific gravity and surface tension between oil and water. The unit's 10cm-wide belt attracts oil from the surface of the water, travels over the head pulley and through tandem wiper blades which scrape the oil off both sides of the belt.

Tel: +1 440 543 7400
Fax: +1 440 543 7404

A breath of fresh air for tankers

The new Xendos 1800 Marine paramagnetic oxygen analyser from Servomex, supplied complete with its own wet gas sampling panel, provides accurate inert gas monitoring for tankers and onshore/offshore installations.

The unit is claimed to require less maintenance and re-calibration than other oxygen analysers on the market and is said to operate continuously for a number of years. Easy to set up and operate, the unit is also claimed to make a major contribution to the speed and efficiency of docking and cargo safety, thus saving money.

The analyser can measure oxygen concentrations from 0% to 100% and has both 4-20mA isolated and 0-1Vdc non-isolated analogue outputs. Accuracy and sensitivity can be maximized by selecting one of the five oxygen measuring ranges: 0 to 2.5%, 0 to 5%, 0 to 10%, 0 to 25% or 0 to 100%.

Offering an overall response time of less than 12 seconds to ensure safe operation, the unit is also fitted with oxygen concentration and sample flow failure alarm outputs that can be easily integrated with safety and operational systems.

Tel: +44 (0)1892 652181
Fax: +44 (0)1892 662253

Handy corrosion thickness meter

The new Alphagage corrosion thickness meter from Sonatest is designed for use in the petrochemical and refining industries and in marine vessel inspections.

Features include the storage of more than 8,000 thickness readings with optional A-scan display, a broad band amplifier which will work with standard probes and measurement from less than 0.5 mm. Resolution is claimed to be 0.01 mm and is compatible with flaw detection transducers.

Tel: +44 (0)1908 316345
Fax: +44 (0)1908 321323

Offshore rig data

Douglas-Westwood has been appointed sole regional distributor for the new ODS Worldwide Offshore Rig Locator System, odsWORLDsystem. The system is a Windows-based programme that gives the user instant access to comprehensive, up-to-date source information on the worldwide offshore drilling fleet. The data is updated monthly by diskette.

The user can see on screen information such as rig supply, demand, utilization, location, contract status, equipment, specifications and availability.

The system can also generate data for combinations of rig types, countries, markets, operators, contractors, etc. It also has the ability to display a rig timeline which generates a graphical presentation of any rig's known contract commitments.

Tel: +44 (0)1227 831879
Fax: +44 (0)1227 832092

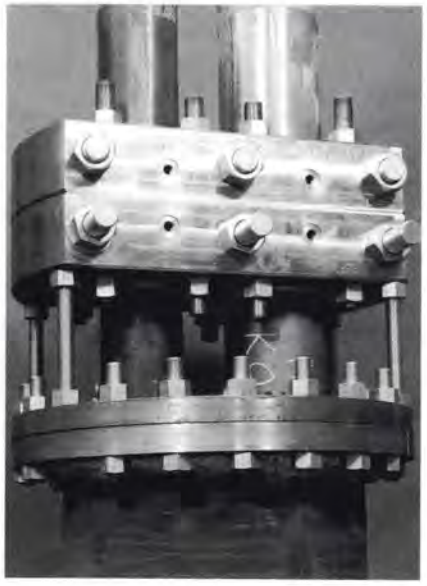
Portable density meter

Paar Scientific has introduced a new lightweight portable density meter weighing just 275 grammes. The DMA35N meter has a pipette-style pump which is said to provide a consistent sample flow. It is operated simply by depressing a lever. The sample is expelled by another press of the lever. A 2-millilitre sample is collected.

A large LCD display shows sample density and temperature. The operator can choose to view density, specific gravity or % concentration. Up to 1,000 data points can be stored in the instrument's memory for later downloading to a PC for printing. The unit can operate for up to 90 hours on two AAA micro-batteries.

Tel: +44 (0)181 540 8553
Fax: +44 (0)181 543 8727

Weld-free riser tie ins



A new permanent riser pipe cold hang off system based on Hydratight's patented ball bearing gripping mechanism is said to eliminate the problem of anchoring riser pipe movement at the top of J tubes and floating production, storage and offloading vessel jumper spools.

The system utilizes a Morgrip mechanical coupling as a permanent join between the riser pipe and pipework topside, thus eliminating the need for welding and a hot work permit, states the manufacturer. The lack of welding also means that tie ins, retrofits and upgrades are possible at any time as a shut down of operations is not required. Installation time is also reduced.

Tel: +44 (0)121 505 0600
Fax: +44 (0)121 505 0800

Tidier trenching with new jet head

A new dredging system has successfully completed an 18-month field trial conducted by Tideway and Dredging International.

The patented jet flowhead system is claimed to improve the efficiency of pipeline landfall and offshore trenching operations. Its water jet flowhead can cut a deep trench in one pass and, in many situations, eliminates the need for a conventional offshore pre-sweep operation, states the Antwerp-based company. This, in turn, provides project cost savings.

The system was developed to overcome the disadvantages associated with existing propeller-driven systems which scatter material in all directions, including the trench line to front and rear. This problem is avoided by the jet flowhead as its head distributes material evenly to each side of the trench line to leave a clean, deep trench.

The jet digging force from the flowhead's combination of fine nozzles and twin main jets is said to be much greater than that found with conventional trenching systems. According to the company, a 10 bar jet from the system can cut a 2-metre deep trench with a 10- to 15-metre bottom width in sand at first pass. Even in clay, the first pass is said to produce a 1.5-metre deep trench.

A specially developed computer system allows fine positioning of the head for additional passes. It allows the operator to adjust the angle of the main jets and, thereby, alter the width and profile of the trench.

The system also enables trenching operations to be conducted after pipe is laid. It is also said to be particularly suited for use in shallow water where the use of a plough might cause difficulties.

Tel: +32 3 250 52 11
Fax: +32 3 250 56 50

If you would like your new product releases to be considered for our Technology News pages, please send the relevant information and pictures to:
Kim Jackson
Deputy Editor, *Petroleum Review*
61 New Cavendish Street, London W1M 8AR, UK

The George Sell Prize

This prize, value £250, is awarded periodically to the author of what is judged to be the best original petroleum technical paper of recent publication. The subject matter may relate to any aspect of petroleum technology viz. exploration, refining, chemistry, physics, environmental science etc. Reviews and publications of joint authorship are not accepted. Applicants for the 1997 award should send copies of their papers, in English, that have been published during 1996/1997 with a covering letter to:

Mr John Evans, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, UK.

UK Deliveries into Consumption (tonnes)

Products	†Sep 1996	*Sep 1997	†Jan-Sep 1996	*Jan-Sep 1997	% Change
Naphtha/LDF	236,378	325,912	2,109,771	1,583,035	-25
ATF – Kerosene	749,956	780,121	6,062,433	6,332,986	4
Petrol	1,803,117	1,800,473	16,524,366	16,657,236	1
of which unleaded	1,228,100	1,310,736	11,105,185	11,854,214	7
of which Super unleaded	48,495	39,042	545,898	393,370	-28
Premium unleaded	1,179,605	1,271,694	10,559,287	11,460,844	9
Burning Oil	226,017	251,246	2,346,596	2,343,823	0
Derv Fuel	1,205,263	1,297,713	10,656,990	11,118,752	4
Gas/Diesel Oil	604,889	586,483	5,697,088	5,411,978	-5
Fuel Oil	565,441	220,261	5,092,304	2,971,973	-42
Lubricating Oil	69,843	71,302	650,134	657,062	1
Other Products	762,261	680,889	6,610,663	6,427,769	-3
Total above	6,223,165	6,014,400	55,750,345	53,504,614	-4
Refinery Consumption	536,341	531,570	4,899,712	4,839,240	-1
Total all products	6,759,506	6,545,970	60,650,057	58,343,854	-4

† Revised with adjustments *preliminary

Membership News

NEW MEMBERS

Mr R Abel, Oikos Storage Limited
Eng A Balkrishnan, National Oil Distribution Company
Mr G Booker, Oikos Storage Limited
Mr H K Bowers, Canvey Island
Mr A Bradley, Wood Mackenzie Consultants Limited
Mr P M Burge, Baker Hughes Inc
Miss E Caglieri, London
Mr S Capon, The Sumitomo Bank Limited
Mr R A Clay, Conoco Limited
Mr E Cnudde, Fina Marine SA
Mr D A Cridland, Lutterworth
Miss Y Crowther, London
Mr D Davies, Graypen Limited
Mr J N W Denholm, Denholm Shipping Services Limited
Mr T R Dent, Canvey Island
Mr P M Dillon, Morgan Bruce
Mr J T Dorgll, Tamarad Enterprises Nigeria
Mr G du Preez, Sasol Oil (Pty) Limited
Mr D Dungate, Twickenham
Ms E V Eccleston, Weatherall Green & Smith
Mr L Elugbadebo, Calson Services (UK) Limited
Mr W G Goldsmith, BP Oil UK Limited
Mr P C Gomez, Pemex Refinacion
Mr R W Graham, South Africa
Mr D W Haigh, Hindhead
Mr B J Hayball, BP Oil UK Limited
Mr J M F Hayes, Lubrizol Limited
Mr S R Hollinger, Northern Ireland
Mr K D Hollocks, Oikos Storage Limited
Mr J D Ignatovich, Ulceby
Mr W P Joyce, Irish Refining plc
Mr J Kearney, Burmah Castrol (Ireland) Limited
Mr S Keen, Stanford-le-Hope
Mr A H Kerr, Wantage
Mr K A Kirk, Epsom
Mr J Knakis, Hydro Texaco Latvia
Mr S W Lam, Hong Kong
Dr I H Lavering, Bureau of Resources Sciences
Mr P Leadbetter, Chorley
Mr J Lee, Leigh-on-Sea
Mr C K Leung, Hong Kong
Mr R Lichte, France
Mr F W MacDonald, City Market Finance
Mr M A Manan, Shell UK Limited
Mr G McBlain, Northern Ireland
Miss L J McCann, Cranleigh
Mr A McCashin, McCashin's Service Stations Limited
Mr E Medina Rodriguez, London
Mr J A G Miller, Texaco Inc
Mr C G Monks, Spritemech Limited
Mr D K Moore, PanCanadian North Sea Limited
Mr W J Moore, Aberdeen
Mr G P Muttitt, Oxford
Mr L E Nelkin, Genesis Engineering Consultants
Mr J T Okubote, Nigeria
Mr D G Payne, Grays
Mr P E Peck, AP Engineering & Construction Limited
Mr T H Pielech, USA
Mr T J Preston, Northumberland
Mr A Price, Kidde International
Mr D J Rhodes, Shell International Limited
Mr R Richmond, Alan Cobham Engineering Limited
Mr D Roberts, Inspectorate Watson Gray (SA) Limited
Mr D A Rowell, Harpenden
Mr J H Rudd, Ruislip
Mr D Sakhokia, Parliament of Georgia
Mr G Sampino, Monaco
Mr D V Savin, Thailand
Dr D A Spencer, University of Maine
Mr A D Stenner, Denholm Shipping Services Limited
Miss J Traynor, Sema Group
Ms W van Asbeck, MeesPierson NV
Mr A Van Der Ende, ASEP UK Limited
Mr D Volpato, Sevenoaks
Mr J von Stackelberg , EMC – Energy Market Consultants Limited
Mr D Wakeling, Grays
Mr A D Wheeler, Mining Journal Research Services
Mr R J Wheeler, Redditch
Mr I M Wiseman, Leigh-on-Sea
Mr J R Wood, Van Ommeren Tank Terminals plc
Mr J A C Woodrow, Petroleum Express Limited

NEW STUDENTS

Mr M J J Murphy, South Wirral
Mr K L Ng, Imperial College
Mr C B Sadler, Croydon
Mr D G Walker, Aberdeen

IP THE INSTITUTE OF PETROLEUM

Branch Regional Organizer

The IP seeks a Branch Regional Organizer...

What is a Branch Regional Organizer?

A Branch Regional Organizer is someone who will have substantial knowledge of the industry and the Institute. We think that the likely person has probably just retired or is going to retire and is seeking part-time employment, and is currently living in the North of England.

What will a Branch Regional Organizer do?

The Branch Regional Organizer will support the Branches which are based in the North of England. Primarily they will help the Northern Branches develop branch programmes, find speakers, help target audiences and liaise with current and potential corporate members.

I am interested, what skills should I have?

The Branch Regional Organizer will be someone who is highly committed to the Institute, has good presentational and organizational skills and is enthusiastic and motivated about the IP and its activities.

I could work part-time – how much is involved?

The BRO is someone who could spare two, possibly three days a week – that's just 100 to 130 days per year. The IP will pay at a per diem rate of £100 + travelling expenses

I am still interested, what should I do next?

Please send your CV and a letter which details why you are suitable for the job to:

John Evans, Membership Services Director,
IP, 61 New Cavendish Street, London W1M 8AR

Membership News

NEW CORPORATES

The Alphatania Partnership, Alphatania House, 82 Rivington Street, London EC2A 3AY
Representative: Mr James R Ball
The Alphatania Partnership is involved in management training in natural gas, commercial, logistical, financial, political, contractual, planning areas and consultancy to the gas industry.

Scottish Enterprise Energy Group, 10 Queens Road, Aberdeen AB15 4ZT
Representative: Mr Gareth Gilbert, Research Executive
Scottish Enterprise Energy Group is the principal economic development agency in Scotland. The Energy Group based in Aberdeen, has responsibility for strengthening the Scottish Oil and Gas, power generation and renewable cluster both at home and overseas.

Strath Services Ltd, Gladsmuir House, Castlehill Road, Kilmacolm, Renfrewshire PA13 4EL
Representative: Captain J Anderson, Director
Strath Services Ltd provides management manning and operating services for oil terminals and related activities. The services may include the control of storage and the receipt of delivery of product to terminals by ship, railcar, pipeline and road vehicle. The company also offers a range of specialist marine services to harbour or jetty operations.

Electrical Safety Systems Ltd, Michael's Mount, 81 Station Road, Sutton in Ashfield, Nottinghamshire NG17 5FY
Representative: Mr Digby Maxwell, Engineering Manager
Electrical Safety Systems Ltd is involved in the supply of safety related electrical inspection and testing and maintenance services. It supplies electricians to drilling contractors and service companies, including SCR trained electricians for emergency response for long-term contracts.

RS Associates, Rainbows End, 30 Mays Lane, Stubbington, Fareham, Hants PO14 2EW
Representative: Mr D G Blake, Marketing Director
RS Associates is the market specialist for innovative products and services to the petrochemical industry. Both ground and air with particular interest in developing British technology for export.

Obituary

The Institute of Petroleum regretfully reports the death of Mr Cyril McCue, FInstPet, who died on 18 October 1997 aged 77. He was employed at Esso Research, Abingdon whom he represented on the IP's Standardization Committee, joining the Committee in 1956. Mr McCue was appointed Deputy Chairman of the Committee in 1969 and Chairman in 1971, a post he held until his retirement from the Committee in 1975. Mr McCue had a long association with the IP and received an Award of Council in 1976 for his work on the Standardization Committee.

Around the Branches

A full listing of Branch Events is available on the IP web site:

http://www.petroleum.co.uk/petroleum/

or, if you require further information please contact your individual Branch Secretary.

What is Lifetime Learning?

Lifetime Learning means quite simply *learning as a way of life*. In today's business climate, you, the individual must now take responsibility for your own 'employability' and the management of your own career. There is a growing and continuing need to retrain, develop new skills and acquire additional expertise so as to remain employable.

Where does the IP fit into Lifetime Learning?

Membership of the IP gives you the opportunity to use the services which are vehicles that deliver Lifetime Learning. Reading *Petroleum Review*, attending a Conference, participating in a Discussion Group or Branch meeting, keeping up to date on the current news via the IP's web site are all part of and embrace the concept, Lifetime Learning.

When will I know that an event/service is part of Lifetime Learning?

The IP is developing a 'Lifetime Learning' logo and when the event or publication is seen to deliver a lifetime learning opportunity, we will stamp the logo on our literature.

What will the IP do for me?

The IP is creating a Lifetime Learning framework which you can use to manage your own development.

When will this happen?

We will launch the IP's Lifetime Learning Plans in a supplement to the February 1998 edition of *Petroleum Review*. So, keep watching this space...

NEW Publications

The North Sea Contracting Industry – Key issues and companies

P J C Wright (FT Energy, Maple House, 149 Tottenham Court Road, London W1P 9LL, UK). ISBN 1 85334 632 2. 192 pages. Price: £350 ($560).

The North Sea contracting industry is in the midst of major structural changes, the maturing province and the need to compete for investment with other oil producing regions altering the traditional roles of both operators and contractors in the region. In addition, a combination of technological improvements, cost reducing initiatives and novel contracting strategies such as partnering and alliancing are transforming the North Sea oil and gas industry as a whole. This publication provides in-depth profiles of major contracting organizations covering their manpower, facilities, expertise, future direction and financial details, to provide a clear picture of the players, their weaknesses and strengths, and this sector of the industry's likely direction into the next century.

Hibernia – Promise of Rock & Sea

Editor: Lara Maynard (Breakwater Books, 100 Water Street, PO Box 2188, St John's, Newfoundland A1C 6E6, Canada). ISBN 1 55081 130 4. 208 pages. Price: $59.95.

This book charts the progress of the Hibernia project. Accompanied by a number of colour photographs highlighting the various facets of the project, including the milestones reached at the Bull Arm fabrication yard in Newfoundland during construction of the platform, the text places the project within the historical context of Newfoundland and features commentary from the industry professionals and workers on the project.

European Oil Industry Guideline for Risk-Based Assessment of Contaminated Sites

(CONCAWE, Madouplein 1, 1210 Brussels, Belgium). 52 pages. Price: No charge.

Prepared for the CONCAWE Water Quality Management Group by its Special Task Force (WQ/STF-27), this report (no 2/97) proposes a three-tiered approach to assessing the condition and corrective action requirements for oil industry sites ranging from complex refineries down to retail service stations. The proposal uses the principal of risk-based corrective action which follows a flexible approach to decision making whereby corrective action is appropriately tailored to site-specific conditions and hazards. This leads to more cost-effective solutions and allows the greatest effort to be targeted to where it is most beneficial.

The Network Code – Commercial and Operational Implications for the UK Gas Industry

Mike Madden (FT Energy, Maple House, 149 Tottenham Court Road, London W1P 9LL, UK). ISBN 1 85334 725 6. 143 pages. Price: £395 ($632)

The liberalization of the UK gas industry is opening up the domestic gas market of 19mn households to full competition. This report describes the history and management of the Network Code – introduced in 1996 in a bid to manage the smooth running of the liberalized UK gas industry – which defines the rights and responsibilities of all users of Transco's UK gas distribution pipeline network. The publication addresses the Code's effect on the industry, commercial and operational implications, key regulatory issues, its main aims and the effects on the main players in the UK gas industry.

Task Risk Assessment

(CONCAWE, Madouplein 1, 1210 Brussels, Belgium). 44 pages. Price: No charge.

Prepared for the CONCAWE Safety Management Group by the Special Task Force on Task Risk Assessment (S/STF-6), this report (no 3/97) explains what Task Risk Assessment (TRA) is and how it is used in the petroleum industry in a bid to control risk to workers. Typical techniques are covered with respect to the upstream, refining, marketing and retail sectors and the extent of risk exposure.

Decommissioning Offshore Installations

Sue Coleman (FT Energy, Maple House, 149 Tottenham Court Road, London W1P 9LL, UK). ISBN 1 85334 865 1. 214 pages. Price: £395 ($632).

Under current legislation, nearly 95% of the world's existing offshore installations will need to be completely removed over the next 30 years at a cost of up to £40bn. This book provides an analysis of the key issues including safety considerations, environmental impact and public relations, together with a guide to new developments and techniques. Statistical data, including distribution of installations, day rates and energy expenditure, is presented in both tabular format and in figures. The book also offers forecasts of future developments from design issues to business opportunities and implications throughout the offshore industry.

Critical Issues in Energy Risk Management

(Price Waterhouse, World Energy Group, 1201 Louisiana, Suite 2900, Houston, TX 77002-5678, USA). Price: No charge.

The volatility of the natural gas, power and crude oil markets has led many energy companies to reassess their risk management activities and derivatives use in a bid to assure a comprehensive, balanced energy risk management programme across all operating segments and product lines. This report provides such companies with a reference point for informed decision making by company directors about the management of financial risks.

The Energy Report – Shaping Change Volume 1, 1997

(The Stationery Office, The Publications Centre, PO Box 276, London SW8 5DT, UK). ISBN 0 11 515430 2. 314 pages. Price: £35.

Volume 1 of the UK Department of Trade and Industry's annual Energy Report provides an overview of the UK energy industry, sector by sector and with statistical appendices providing a historical perspective. Highlighting those issues with far-reaching impact on the country's use of energy, it also addresses international developments relating to the environment and energy efficiency. For the first time, the report also includes papers from the Energy Advisory Panel.

Multiphase '97 – How Deep? How Far? How Soon?

(Mechanical Engineering Publications Ltd, Northgate Avenue, Bury St Edmunds, Suffolk IP32 6BW, UK). ISBN 1 86058 089 0. 632 pages. Price: £139 (plus 10% for delivery outside the UK).

This publication is a compilation of the papers presented at the Multiphase '97 conference held in Cannes, France, on 18 to 20 June 1997. Focusing on what the latest technology can achieve, its limitations and how these are being overcome, it covers two- and three-phase operations, experimental results, boosting and separation, measurement and problem scenarios.

IP Conferences and Exhibitions

IP Week 1998

London: 16–19 February 1998

An influential programme of Conferences appealing to an international audience has been planned, which together with the Annual Luncheon and Dinner, means that IP Week 1998 represents an excellent opportunity for delegates to meet and discuss the latest developments with senior executives in the industry today. Please see pages 576–577 for detailed information on the Programme of Events.

Conference and Exhibition

Oil Spill Response – The National Contingency Plan

Gatwick: 10–11 March 1998

organized with the support of UKPIA, the British Oil Spill Control Association (BOSCA) and the Nautical Institute

In recent years, the UK has suffered two large oil spills. One of these involved the largest shore-line clean-up in the UK since the *Torrey Canyon* incident over 30 years ago. In light of these incidents, the National Contingency Plan has been reviewed and revised.

This Conference will address all the important issues:

Day 1 – Policy and the National Plan; Role of Local Government, the Environment Agency, Ports and the Spill Response Industry; Funding and Finance

Day 2 – Media Coverage, Waste Disposal, Health and Safety Issues, Setting-up Shore Line Response Centres and New Clean-up and Monitoring Techniques

Speakers include: **Glenda Jackson CBE, MP** (Parliamentary Under-Secretary of State, Department of the Environment, Transport and the Regions), **David Bedborough** (Chief Scientist, MPCU), **Dr Mike Frend** (Director General, UK Petroleum Industry Association), **Robin Gainsford** (Director, MPCU), **Chris Harris** (Chief Executive, The Coastguard Agency), **Gordon Johnston** (Executive Director, UKMPG Ltd), **Rear Admiral Michael L Stacey** (Chairman, British Oil Spill Control Association) and **Dr I C White** (Managing Director, International Tanker Owners' Pollution Federation).

Who should attend?
Attendance at this event will be essential for Ports and Harbours Authorities, Shoreline Local Authorities, those responsible for the formulation of contingency plans and those involved in oil spill response and shoreline remediation.

Exhibition
An Exhibition of oil spill response equipment and remediation techniques will be held in association with the Conference. Further information regarding exhibition space is available from the Conference Department.

The Programme and registration form is now available from the IP Conference Department.

International Conference and Exhibition

Metalworking Fluids

Birmingham: 3–4 June 1998

The Programme and registration form will be available in February 1998.

Annual Introduction Courses

The Institute of Petroleum's annual three-day non-residential general Introduction Courses to the oil industry have proved extremely successful and will be repeated again in June 1998. Each Course is self-contained but many participants will find it advantageous to attend both, in which case a special combined registration fee is available at a reduced rate.

Introduction to Oil Industry Operations

London: Wednesday 17–Friday 19 June 1998

and

Introduction to Petroleum Economics

London: Monday 22–Wednesday 24 June 1998

The Courses are particularly valuable for:

- Participants from within the oil industry who require a broader perspective of the industry's activities and the economic factors affecting its development
- Participants from financial and commercial companies, supply and service sectors and government organizations who require an informed and concise introduction to the economic and commercial background of the oil industry.

The Programme and registration form will be available in April 1998.

For a copy of the Programme and registration form for the Oil Spill Response Conference or to add your details on to the mailing lists for forthcoming events, please write or fax:

Pauline Ashby, Conference Administrator, Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, UK
Tel: +44 (0)171 467 7100
Fax: +44 (0)171 255 1472
All forthcoming events can be viewed on the IP Web Page:
http://www.petroleum.co.uk/petroleum/

MOVES People

Otto Saberg has been appointed as Executive Vice-President of Aker Maritime. Saberg will become designated Chairman of the company's Finnish shipyard Aker Finnyards, with responsibility for developing the yard further.

Chris Montgomery has joined BICC Components in the role of Sales Manager. He will be responsible for coordinating relationships with specifiers, contractors and oil and gas companies.

Phil Smith takes over from **Lasse Petterson** as Managing Director of Aker Oil and Gas Technology in Aberdeen. Petterson will become President of parent company Aker Maritime UK.

UK Offshore Operators Association (UKOOA) has appointed **Steve Harris** to the new post of Director of Communications. Harris joins UKOOA from the Consumers' Association where he has been Communications Director for the past two years.

Alessandro Gilotti has been appointed as Managing Director of Kuwait Petroleum (GB) replacing *Owen Jenkins*, who will be retiring at the end of December. Gilotti has a broad background within Kuwait Petroleum SpA and will be based in Rome.

Henry French Jr has been appointed General Counsel for Zurich Global Energy's newly launched claims network for the Energy Industry. French, formerly Vice President, Coverage and Claims Advisor of J&H Marsh & McLennan Global Broking has nine years experience as an insurance coverage and litigation attorney.

The PSL Group has appointed *Kevin Smith* to the position of QHSE Manager, with responsibility for managing Quality, Health, Saftey and Environmental systems throughout the Group's activities.

R Gregory Rich has been appointed as Chairman and President of Amoco Canada Petroleum Company. Current Chairman and President, **Bob Erickson** will be relocating to Baku, Azerbaijan, to take up the position of Chief Operating Officer with Azerbaijan International Operating Company, a 12-company consortium led by Amoco Corporation and British Petroleum.

Peter Cloney has been appointed Sales Manager of Prescision Polymer Engineering, with responsibility for developing UK and international markets.

Richard Wiseman has been appointed to the Board of Shell UK as Legal Director, with effect from 22 October. Wiseman has been Head of Legal Division and Company Secretary to Shell UK since December 1992, and in his new role will continue as the company's General Counsel. He will in addition become responsible for the company's property interests.

The Federation of European Bearing Manufacturers' Association (FEBMA) has elected **Maurice Amiel** of Timken France, as its new President. Amiel succeeds **Mauritz Sahlin** of SKF in Sweden, who held the position of FEBMA President for the last four years. Other new appointments include the election of **Lorenz M Raith** of INA Germany as FEBMA Vice President and Hartmut Rauen of VDMA Germany as the new General Secretary.

Pogo Producing Company has promoted **Stephen R Brunner** to Vice President – Operations, **David R Beathard** to Vice President – Engineering, and **Frank Davis III** to Vice President – Land.

Parker Filtration, part of Parker Hannifin Corporation has appointed *Jeff Smith* (right) as European Marketing Manager. The company has also promoted *Nigel Gregson* to the position of Hydraulics Product Manager and *John Solomon* to the position of Automotive Specialist.

Nikolai Sviridov has been appointed to the Board of Directors of Norske Energy Corp. Former Deputy Chairman **Raymond A King** has been promoted to the position of Chairman and **Emmett O'Connell**, former Chairman has assumed the role of Deputy Chairman.

Martin Byatt (top) and *Michelle Dunne* (below) have been appointed energy lawyers in the Energy Department of Clyde & Co. The pair have previously worked together as partners in a natural resource and corporate finance practice started by Byatt in 1970. Byatt is a specialist in setting up, funding and developing international and UK projects involving oil, gas, coal, precious metals and minerals and Dunne specializes in the UK and international oil industry, including the UK, European and Scandinavian licensing rounds.

Christopher Hampson has been appointed non-executive Director of BG plc. Currently non-executive Chairman of RMC Group plc, he is a former Chairman of Yorkshire Electricity Group and has a wide experience of regulatory issues and international business.

Amec plc has appointed **John Young** as Finance Director of Amec Process and Energy Ltd. Young will be based in London and will report directly to the company's Managing Director, **Roddy Grant**.

The Non-Operators' Forum has appointed a new Chairman, **Brian Rhodes**, who is the Managing Director of Cultus Petroleum (UK) Ltd and a new Secretary, **Martyn David**, Chairman of MRD Consultants and a former Chairman of the Forum.

Syntroleum Corporation has appointed **Paul E Kennedy** to the post of Chief Process Engineer. Kennedy joins Syntroleum from The Pro-Quip Corporation where he was Manager of Technology Development, involved in the construction of process plants for the petroleum industry.

EVENTS Forthcoming

December

4–5 **London**
Floating Production Systems
Details: IBC UK Conferences Ltd
Tel: +44 (0)171 637 4383
Fax: +44 (0)171 4453 2712
e-mail: sonia.klaege@ibcuk.co.uk

5–8 **Buckinghamshire, UK**
The Mechanics & Operations of Oil Trading
Details: Petroleum Economist, UK
Tel: +44 (0)171 831 5588
Fax: +44 (0)171 831 4567

6–10 **Muscat, Oman**
Bulk Liquid Measurement
Details: Abacus International, UK
Tel: +44 (0)1245 328340
Fax: +44 (0)1245 323429

8–9 **London**
Management of Fire and Explosions
Details: Anne Lomax, Institution of Mechanical Engineers, UK
Tel: +44 (0)171 973 1261
Fax: +44 (0)171 222 9881
e-mail: a_lomax@imeche.org.uk

8–9 **Coventry, UK**
The International Energy Experience: Markets, Regulation and Environment
Details: Mary Scanlan, BIEE, UK
Tel: +44 (0)181 997 3707
Fax: +44 (0)181 566 7674

8–9 **London**
3rd International Forum on Ship Arrest
Details: IBC UK Conferences
Tel: +44 (0)171 453 2107
Fax: +44 (0)171 453 2117

8–9 **Aberdeen**
Meeting Environmental Standards for the Offshore Industry
Details: IBC UK Conferences
Tel: +44 (0)171 637 4383
Fax: +44 (0)171 453 2058
e-mail: caroline.murgatroyd@ibcuk.co.uk

8–9 **London**
New Entrants in Global Power Generation
Details: IBC Financial Focus, UK
Tel: +44 (0)171 453 2703
Fax: +44 (0)171 323 4298
e-mail: rebecca.luing@ibcuk.co.uk

8–12 **Caracas**
Environmental Management Implementation in the Oil & Gas Industry
Details: MD Consultancy, UK
Tel: +44 (0)1224 626268
Fax: +44 (0)1224 626950
e-mail: 106334.2720@compuserve.com

10–11 **Amsterdam**
Cost Effective Drilling
Details: International Quality & Productivity Centre, UK
Tel: +44 (0)171 691 9191
Fax: +44 (0)171 691 9192

10–11 **London**
Subsea '97
Details: Knighton Enterprises, UK
Tel: +44 (0)1367 242525
Fax: +44 (0)1367 241125
e-mail: sen@btinternet.com

11–12 **Houston**
Subsea Pipeline Technologies
Details: IBC USA Conferences
Tel: +1 508 481 6400
Fax: +1 508 481 7911
e-mail: reg@ibcusa.com

15–16 **London**
2nd World Annual Baseoils Conference 1997
Details: ICIS-LOR, UK
Tel: +44 (0)181 652 3535
Fax: +44 (0)181 652 3929
e-mail: sales.uk@icislor.com

18-19 **Austria**
The Russian Refining Roundtable
Details: World Refining Association, UK
Tel: +44 (0)1242 529090
Fax: +44 (0)1242 529060

January 1998

18–20 **Perth**
Australasian Energy Pacesetters '98
Details: Global Pacific & Partners, South Africa
Tel: +27 11 781 3358
Fax: +27 11 781 3362
e-mail: global.pacific.@pixie.co.za

18–23 **Wiltshire, UK**
The Challenge of Liberalising Gas Markets
Details: The Alphatania Partnership, UK
Tel: +44 (0)171 613 0087
Fax: +44 (0)171 613 0094

19–20 **Stavanger**
Advances in Seismic Technology
Details: IBC UK Conferences
Tel: +44 (0)171 453 2712
Fax: +44 (0)171 453 2058
e-mail:
angela.broadhead@incuk.co.uk

21-22 **Aberdeen**
Alliancing and Contracting in the Oil & Gas Industry
Details: Learning in Business, UK
Tel: +44 (0)181 944 9030
Fax: +44 (0)181 944 0434
e-mail: book@learnbus.demon.co.uk

26–27 **Istanbul**
Mediterranean & Black Sea Oil Markets
Details: IBC Financial Focus, UK
Tel: +44 (0)171 453 2703
Fax: +44 (0)171 323 4298
e-mail: rebecca.luing@ibcuk.co.uk

28–29 **London**
Knowledge Management
Details: IBC UK Conferences
Tel: +44 (0)171 453 5494
Fax: +44 (0)171 636 6858
e-mail: cust.serv@ibcuk.co.uk

February 1998

2–4 **London**
Petroleum Economics
Details: IBC UK Conferences Ltd
Tel: +44 (0)171 453 5491
Fax: +44 (0)171 636 6858
e-mail:cust.serv@ibcuk.co.uk

4 **London**
Transforming Indian Energy: Government Policy and the Role of Foreign Investment
Details: The Royal Institute of International Affairs, UK
Tel: +44 900171 957 5700
Fax: +44 (0)171 321 2045

5–6 **London**
Climate After Kyoto: Implications for Energy
Details: The Royal Institute of International Affairs, UK
Tel: +44 (0)171 957 5700
Fax: +44 (0)171 321 2045

5–6 **London**
Risk Analysis
Details: IBC UK Conferences
Tel: +44 (0)171 453 5491
Fax: +44 (0)171 636 6858
e-mail: cust.serv@ibcuk.co.uk

10–13 **Cairo**
Oil & Gas '98
Details: IIR Exhibitions, UAE
Tel: +971 4 365161
Fax: +971 4 360137

13–16 **Berkshire, UK**
Understanding Oil Supply Logistics
Details: Petroleum Economist, UK
Tel: +44 (0)171 831 5588
Fax: +44 (0)171 831 4567/5313

24–25 February
London: *The CRINE Network Conference*
Details: CRINE Network
Tel: +44 (0)171 412 4300
Fax: +44 (0)171 412 2971

Diary Dates

Exploration & Production Discussion Group

'Whose Oil Is It Anyway? – International Boundary Disputes and Hydrocarbon Production'

Thursday 8 January, 1998
17.00 for 17.30 until 19.00

Martin Pratt, Research Officer, International Boundaries Research Unit, University of Durham

IP Contact: Jenny Sandrock

London Branch

'The Internet – its Value to the Oil Industry'

Wednesday 28 January 1998, 17.15 for 18.00

Fran Morrison, Media & Communications Manager, Shell UK Ltd, plus an IT Contractor

The presentation will focus on the development of a company web site and the benefits of the Internet to companies in the oil industry. The presentation will feature demonstrations linked to the Internet.

Tea and biscuits will be served at 17.15. Light refreshments, kindly sponsored by Shell UK Ltd will be available afterwards.
IP Contact: Mr J M Wood on +44 (0)171 467 7128

All meetings are held at the Institute of Petroleum unless otherwise stated. Please tell the IP contact if you plan to attend any of these free meetings
Tel: +44 (0)171 467 7100
Fax: +44 (0)171 255 1472

Forthcoming Conference

The European Downstream Industry – A Vision for 2010

11–12 December 1997, Paris/Rueil-Malmaison

A joint AFTP-IP-DGMK Symposium
(administrated by AFTP)

Since the early 1980s the European downstream industry has experienced major changes including plant closure, upgrading programmes and other initiatives to improve overall efficiency.

The Symposium provides a vision of how the European downstream industry will adapt and evolve over the next decade.

Over the next 10 to15 years further significant changes are anticipated resulting from:

- changes to European and domestic legislation to resolve health, safety and environmental issues;
- the need to compete with alternative sources of energy;
- the desire to meet customer/market demand both in terms of quantity and quality of products;
- the need to maximize margins from refined products.

The Symposium is jointly sponsored by Association Française des Techniciens du Pétrole (AFTP), Deutsch Wissenschaftliche Gesellschaft für Erdöl, Erdgas und Kohle (DGMK) and the Institute of Petroleum (IP).

Who should attend?
General Managers – Strategists and Planners – Refinery Managers and Engineers – Logistics Managers – Engineering Managers – Marketing Managers – Regulatory Authorities – Equipment Manufacturers – Service Companies.

For further information please contact: **IP Conference Department on +44 (0)171 467 7105**

We wouldn't be here if life were fair

Life can be so unfair. Everything seems to be jogging along reasonably well and suddenly disaster strikes. It could hit any of us at any time.

For one in ten of Britain's population there is a friend to call on when life is at its most unfair.

These men, women and children are employees, former employees (and their dependants) from the motor industry and its associated trades and industries.

That friend is BEN, the occupational benevolent fund that has been providing practical help, support and care to those in distress for over 90 years.

BEN is currently helping thousands of people in the community and looking after hundreds of residents in its four nursing and residential centres.

If you would like to know more about BEN's work or make a donation, please call us on 01344 620191 or fax 01344 622042.

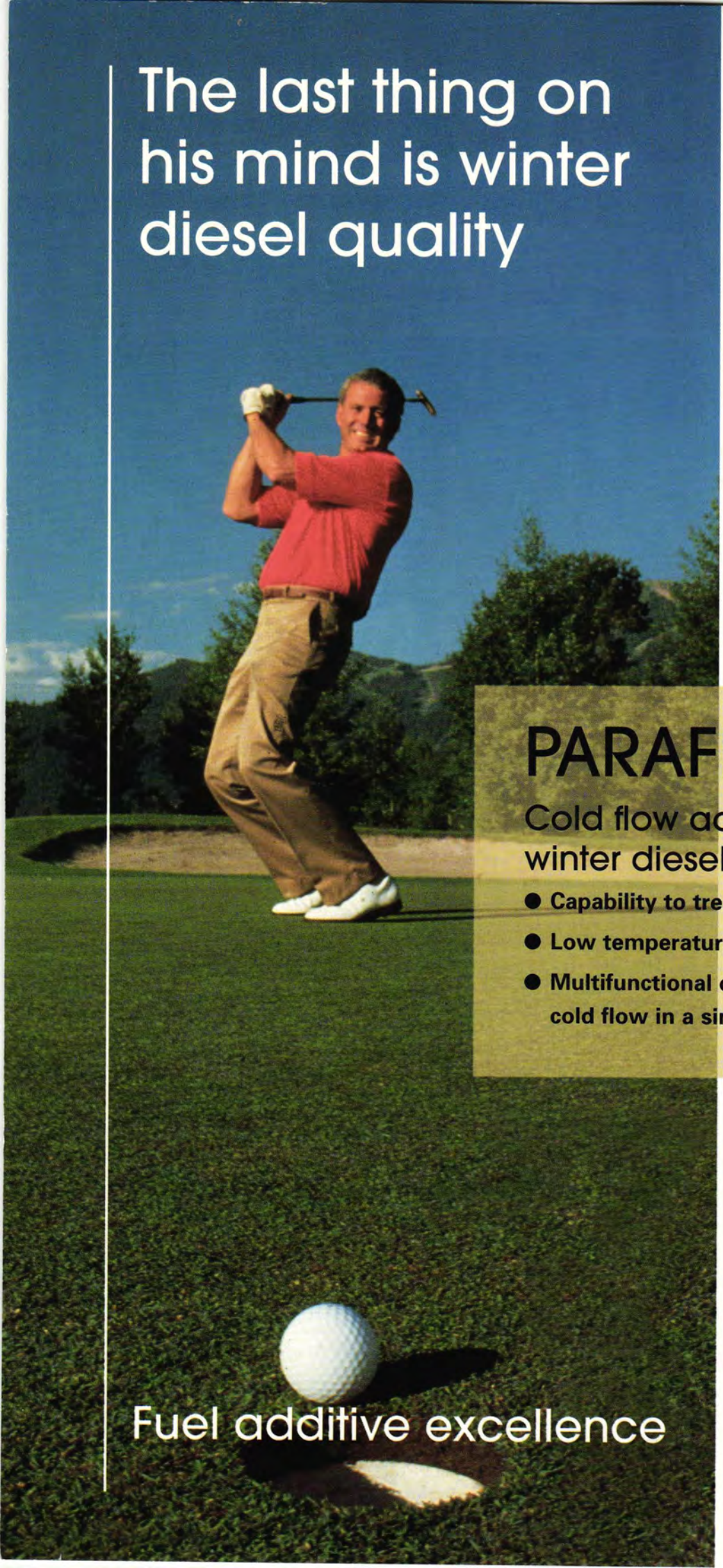
Ben

BEN — MOTOR AND ALLIED TRADES BENEVOLENT FUND

Lynwood • Sunninghill • Ascot • Berkshire SL5 0AJ

Registered Charity No: 297877

The last thing on his mind is winter diesel quality



We aim to keep it that way

When things are running smoothly, it can be difficult to focus on winter preparations. But, to maintain reliable diesel fuel quality and meet winter specifications, now is the time to plan your cold flow additive requirements.

Your customers rely on keeping moving whatever the weather. They look for fuels that they can trust – high quality fuels that can survive in the coldest conditions. Producing a winter diesel fuel that will not let them down demands superior additive technology. Paramins™ expertise and commitment to R&D have produced a range of high quality cold flow products.

PARAFLOW™

Cold flow additives for winter diesel

- **Capability to treat different fuel types**
- **Low temperature operability additives**
- **Multifunctional capability – lubricity and cold flow in a single additive**

Contact your Paramins™ representative to find out more about Paraflow™ cold flow additives. For a reminder of the quality of diesel fuel last winter please call Rose Gill on (+44) 1235 545721 for a copy of our Worldwide Winter Diesel Survey

Fuel additive excellence

PARAMINS

EXXON CHEMICAL LIMITED
Paramins Marketing Communications
P.O. Box 255, Abingdon,
Oxfordshire OX13 6TT
Tel. 01235 545701 - Fax 01235 545715