Petroleum review September 2000



North Sea

A province heading for decline?
 Setting sights subsea

World reserves

Discovery still lags production
 The perils of forecasting

Middle East Rebuilding Irag's oil industry

Covering the international oil and gas industry from field to forecourt – exploration, production, refining, marketing and e-business

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Minale Tattersfield Design Strategy

International Design Consultants for the Energy Sector

OFFICES IN: LONDON, PARIS, MILAN, ZÜRICH, PRAGUE, CASABLANCA, KUWAIT, JEDDAH, U.A.E., KUALA LUMPUR, HONG KONG, OSAKA, TOKYO, BRISBANE, SYDNEY, BUENOS AIRES, RIO DE JANEIRO.



▲ Petrol station design for IP, Italy ▼ Prototype of totem sign for IF

▼ Canopy and totem detail for IP, Italy

Minale Tattersfield has 35 years' experience in petrol station design and has worked internationally for companies including BP, Agip, IP, YPF, Total, Afriquia, Elinoil, Thai Oil, Hydro and Texaco, among others.

In the area of transport design, we have also completed major projects for London Transport, BAA, and Eurostar train.

Speed is essential in the redesign and refurbishment of petrol stations to minimise loss of revenue, however consulting and coordinating specialist design consultancies for each individual area can be time consuming.



▲ Corporate identity for Elinoil, Greece

Minale Tattersfield offers a one stop service, with the experience and expertise to manage your complete project efficiently, from initial concepts through to final completion.

We have specialist skills needed for each area of the complex process of petrol station design.

- · Graphic design for brand identity and signage.
- · Architectural / urban design for the building, canopy, and surrounding landscape,
- Industrial design for petrol pump, car wash, lube bay, selfstanding structure.
- Packaging design for lube products,
- · Retail design for convenience store.



Corporate identity and livery for Eurosta Hammersmith tube station





▲ Packaging for BP ▼ Interior of Heathrow Express





- ▲ Proposal for Heathrow Express
- Identity for IP's self-service stations





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▲ YPF Petrol station contract with Minale, Tattersfield, Piaton & Partners

mintat for AGIP TRANSPORTABLE PETROL STATION

The Mintat (AGIP) petrol station is ideal for areas where environmental constraints restrict the building of permanent stations. Costing considerably less than a permanent petrol station, it is well suited to sparsely populated rural areas in developing countries. It can be used to reduce loss of revenue during the refurbishment of station networks and accommodate the seasonal flow of traffic in tourist areas and at large sporting events.

A transportable, fully autonomous petrol station, built on a modular, container based system of inter-connectable units which can be installed and fully operational in 48 hours. It complies with the latest environmental legislation including a vapour recovery system during discharging and filling and guarantees maximum operating safety. The tanks have a capacity of between 22,000 and 44,000 litres to distribute two types of petrol and diesel if required.



- The standard modules of the transportable service station are composed of:
- Tank Section Size 2.4z
- Office Section Size 2.40 x 9.20 x H 3.30 m.
- Canopy Size 9 x 3.60 x 1.3 m.
- Service Ramps Size 14 x 3.2 x 0.3 m
- Set of External Trimmings Outer fascia, modular cladding panels, tubular protection, outside illumination.
- Utilities Plants Electrical plant and earthing system, lighting plant, fire fighting system, heating plant, fuel dispenser and control system.

▲ Petrol station design for Elinoil, Greece Mintat petrol station designed for Agip



- Signs Two illuminated signs with trademark and company logo, two signs on the fascia, one pricing panel.
- Furnishings and Accessories Internal furnishings, shelves, W.C. service.

The MINTAT MARK II,

incorporating a four hour fire rated tank assembly meeting SWRI 95-03 & 93-01, UFC Standard A-11-F-1 (79-7) and NFPA 30 & NFPA 30A is in the final stages of development.

Your company livery can be applied as illustrated below.





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kW = kilowatts (103)

MW = megawatts (106)

GW = gigawatts (109)

sg km = square kilometres

kWh = kilowatt hour

km = kilometre

b/d = barrels/day

t/d = tonnes/day

ABBREVIATIONS

The following are used throughout Petroleum Review:

- mn = million (106)
- bn = billion (10^9)
- tn = trillion (10^{12}) cf = cubic feet
- cm = cubic metres
- boe = barrels of oil
- equivalent
- t/v = tonnes/vear

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

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Front cover: Shell's Shearwater project in the North Sea is due onstream shortly.









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The Institute of Petroleum as a body is not responsible either for the statements made or opinions expressed in these pages. Those readers wishing to attend future events advertised are advised to check with the contacts in the organisation listed, closer to the date, in case of late changes or cancellations.

ROUNFrom the Editor

Replacing non-Opec reserves

This year we have decided to include a number of reserves articles alongside our annual North Sea feature. The conjunction is appropriate because the North Sea is now a province heading into decline - how imminently and how rapidly remains to be seen. The latest issue (August 2000) of the International Energy Agency's (IEA) Oil Market Report anticipates the three key North Sea players - UK, Norway and Denmark - producing 6.49mn b/d in 2000 and a marginally higher 6.55mn b/d in 2001. The history of project delays suggests that the actual outcome for both years is likely to be somewhat lower. For a more positive outlook, see p4 and p24.

This imminent North Sea decline matters a great deal because North Sea production rose from being under 1% of world production in 1976 to peak at fractionally under 9% in 1996. Over the same period it was the single most important incremental producer of crude. In no less than 12 of the 20 years in the period the North Sea accounted for over 20% of global incremental production while in 1983, 1993 and 1994 it accounted for virtually all the global output increase seen in those years. As a result it exerted a powerful price moderating influence effectively blocking Opec aspirations for higher prices.

In the table below, the IHS Energy Group estimates oil reserve replacement ratios for the top-10 non-Opec producers over the last decade. This clearly shows the promise of Angola and Brazil as incremental producers but also shows the number of non-Opec countries that are now unlikely to be able to expand production. Global capacity is now tight and Opec countries are apparently becoming rather more nationalist and keener on higher prices. This means that as a production counterweight more non-Opec production is needed. Realistically, in the short term, this incremental production can only come from Angola, Brazil, Canada or the Gulf of Mexico. It is depressing to have to report that non-Opec offshore oil production flows have proved rather smaller than anticipated only a few years ago (see p16).

Clash of the Titans

The three mega-majors - ExxonMobil, Shell and BP - have just announced their half-yearly results. These are spectacularly good. Higher oil prices, reduced expenditures, capital write-downs, and a focus on returns have worked their magic. Shell and ExxonMobil accounts indicate a 16% return on average capital employed (ROACE). BP now ostensibly 'Beyond Petroleum' (see p7) reports a spectacular 21% ROACE. The stockmarket resolutely refused to be impressed, citing the complexity of unravelling post-merger accounts for their scepticism. This raises the question as to what return you have to achieve to impress markets who would apparently rather invest in dotcom promises.

Please write

This month we have some provocative articles in the issue. We would like to print a lot of 'Letters to the Editor', so please don't be shy – write, fax, e-mail your views.

Chris Skrebowski

990–1999 38% 54%	1999* 3,345
38% 54%	3,345
54%	2 10F
	3,195
47%	3,195
40%	2,895
195%	840
29%	910
134%	840
29%	835
41%	850
397%	780
68%	
	41% 397% 68% eview 2000: **

Top-10 non-Opec producers' oil reserves replacement 1990–1999**

world

BrentBroker.com recently launched online energy trading system, with claimed commitments from Hess Energy Trading and a number of other large refiners.

Statoil has awarded a contract to Petroweb for the provision of user licences for its well operations staff to access Petroweb's independent Internet-based knowledge exchange network for the oil and gas industry at www.petroweb.co.uk

Six of North America's leading power and natural gas trading companies – American Electric Power, Aquila Energy, Duke Energy, El Paso Energy, Reliant Energy and Southern Company Energy Marketing – have entered into an agreement in principal to purchase an equity position in IntercontinentalExchange, to create what is claimed to be the world's largest online, over the counter (OTC) market for energy and metals.

Fitch, the international rating agency, has published a 16-page summary report on the Caspian energy sector entitled *The Oil is Not Enough*. The report takes a country-by-country look at obstacles facing external investors in the region. It is available free of charge at www.fitchratings.com

BP, Petroplus, Vopak and Marquard & Bahls (which trades under the brand names of Mabanaft and Oiltanking), have unveiled plans to launch an Internet exchange for the Rhinebased shipping sector in 3Q2000.

A new, real-time live energy auction, operating on a 'no deal, no fee' basis, has been launched by Energy Auctions. The site – www.energyauctions.co.uk – is initially opening its electricity trading floor to commercial, wholesale and multiple domestic customers, soon to be followed by gas and oil trading.

Halliburton Energy Services is understood to be acquiring a 15% stake in **PetroleumPlace.com** The alliance will enable PetroleumPlace to serve as an application service provider for some of the leading exploration and production software applications from Landmark Graphics Corporation.

Western Geophysical, a division of the Baker Hughes group, has launched www.infoSeis.com to provide interactive access to the company's worldwide 2D and 3D multiclient seismic data library.

Kognita is planning to launch a business-to-business learning portal service specifically designed for the oil and gas industry in December. It will be possible to access the service at www.oil.site4learning.com For more information, contact Mike Newton at e:mike.newton@kognita.com

In Brief

NEW_{upstream}

UK

Aker McNulty's South Shields yard is reported to have secured a £15–£20mn contract from Talisman Energy (UK) for refurbishment of the Bleo Holm FPSO which will be installed on the North Sea Blake field, due onstream mid-2001.

Coflexip Stena Offshore and ABB Offshore Systems have been awarded the subsea facilities and pipelines contract for Phases 1 and 3 of TotalFinaElf's Nuggets development in the North Sea.

Conoco and Halliburton business unit Brown & Root Energy Services have concluded what is said to be one of the largest oil and gas industry service and support contracts ever awarded in the UK. The £150mn, five-year contract, which includes two further two-year options, covers the provision to Conoco's southern North Sea natural gas business of a wide range of services.

UK Energy Minister Helen Liddell has awarded 37 licences to 21 companies for onshore oil and gas exploration in England, Wales and Scotland. Almost half of the 123 blocks licensed are for the exploration of coal-bed methane and mines gas. This is the first tranche of awards resulting from the 9th UK Onshore Licensing Round.

Shell Expro's Shearwater oil and gas field is reported to have been delayed by over a month, with first production expected as Petroleum Review went to press. Output is expected to peak at 82,000 b/d of condensate and 425mn cf/d of gas.

Europe

Statoil is planning to develop the Svale field in the Norwegian sector of the North sea as a satellite to the Norne field production vessel. The Svale field has reserves put at 100mn barrels of recoverable oil and is slated to come onstream in 2003. The field will help extend plateau production for the Norne ship by two years to 2005.

Statoil's Sygna field in the North Sea is reported to have come onstream. The field is being developed as a subsea tieback to the Statfjord C platform. Production is expected to reach 40,000 b/d of oil by year-end. Recoverable field reserves are put at 53.5mn barrels.

TotalFinaElf has announced the installation of the new satellite platform K4BE

First hydrocarbons found on Kazakh Shelf

Partners in the Offshore Kazakhstan International Operating Company (OKIOC)* have announced that the Kashagan East 1 discovery well in the northeast Caspian Sea has encountered hydrocarbons – the first to be found on the Kazakh Shelf.

The discovery well encountered an oilbearing interval in the Palaeozoic Carbonates below 4,000 metres. Two tests are planned, the first of which flowed 600

UK fallow fields

The UK Department of Trade and Industry's (DTI) Fallow Field Initiative has developed firm work plans for almost 100 formerly dormant licence blocks in UK waters. Of the 199 blocks that were identified as fallow at the beginning of the initiative, three have now been drilled, 19 now have firm drilling plans and a further 77 will see new geophysical work that will either lead to an action plan or to relinquishment within 12 months. A total of 38 have been relinquished or will be relinquished in the next year.

In addition, out of 125 fallow discoveries that were deemed uneconomic to develop, 18 are to be developed and a further 15 offered for sale. cm/d (3,780 b/d) of oil and 200,000 cm/d of gas from a 32/64-inch choke from the lower section of the well. Oil gravity ranged between 42 and 44 degrees API. The well was drilled in 3 metres of water, to a total depth of nearly 5,200 metres.

*OKIOC comprises subsidiaries of Eni, BG, BP Amoco, ExxonMobil, Inpex, Phillips Petroleum, Shell, Statoil and TotalFinaElf.

Echo/Yodel contract

Kvaerner Oilfield Products has secured a contract from Woodside Energy to supply the subsea control system for the Echo/Yodel development project on the North West Shelf offshore Australia.

Field development will be via two subsea wells located in 140 metres water depth, some 24km southwest of the Goodwyn A (GWA) platform. Production of 200mn cf/d to 300mn cf/d of gas will be exported via a 12-inch diameter pipeline to GWA, where it will be commingled with Goodwyn fluids and processed before export into the interfield pipeline.

Green light for Brigantine field

Shell UK Exploration and Production (operator) and Esso Exploration and Production UK have been given the green light by the UK Government to develop the Brigantine A, B and C gas fields in southern North Sea block 49/19, with a small extension of Brigantine B into 49/18.

The £100mn Brigantine development encompasses three fields with reserves of 280bn cf of gas. Due onstream in January 2001, production is expected to reach 130mn cf/d. Four wells (three horizontal, one slanted) will produce gas through two platforms – Brigantine BG and Brigantine BR. The notnormally-manned platforms are based on the Trident platform concept, first applied on the Skiff field earlier this year. The platforms have the minimum of facilities and a light, 500-tonne structure that can be installed by a drilling rig or a conventional marine installation vessel.

Gas will be exported via a 19-km, 20inch diameter pipeline to the Corvette platform and, from there, via existing infrastructure to the Shell/ExxonMobil natural gas terminal at Bacton.

The £5mn contract for the procurement, fabrication and onshore commissioning of the two platforms was awarded to Kye of Lowestoft earlier this year. The work is scheduled to complete by November 2000, with the first platform due to be installed in August. The second platform is slated for installation in 4Q2000.

The low cost of construction, installation and development techniques applied on Brigantine – said to be half that of a conventional platform – is expected to facilitate the future development of more marginal gas fields in the southern sector of the UK Continental Shelf.

NEW_{pstream}

Optimism for UK oil and gas

The price of a barrel of oil rose by a massive 26.2% to \$30.48 in June from \$24.15 in May, reports The Royal Bank of Scotland in its latest *Oil and Gas Index*. Compared with June 1999, this represents a 91.6% increase. The sterling increase in prices has been exacerbated by the pound's recent depreciation against the dollar, comments the report. The daily average price of £20.13/b was 33.3% above May's price and 104% higher than June 1999.

Stephen Boyle, Head of Business Economics at the Royal Bank, said: 'For the first time in over two years there is genuine cause for optimism about prospects for the industry. Higher prices have strengthened operators' finances and are providing a strong platform for increased investment. Also, the fear of low prices – less than \$12/b – becoming a permanent fixture has lifted. Thirdly, falling UK CS costs make the North Sea an internationally competitive oil province.'

Oil production was also on the increase in June, as planned maintenance on a number of fields came to an end. Output rose by 9% on the month to 2,408, 000 b/d. Gas production was down on the month, in line with seasonal expectations, by 4.6%.

/. oil price (\$/b)
15.91
18.90
19.93
22.83
22.03
24.64
25.64
25.63
27.97
27.27
23.15
24.15
30.48

Source: The Royal Bank of Scotland Oil and Gas Index

North Sea oil and gas production

Offshore Europe – upturn is beginning

Total capital expenditure for the European offshore arena is expected to increase from \$9.5bn in 2000 to \$12bn in 2001/2002 before beginning a long, slow decline, according to a new report from energy industry analyst Douglas-Westwood and offshore data specialists Infield Systems. The report – entitled *The Offshore Europe Report* – forecasts that over the next five years European offshore capital expenditure will total \$53bn, with \$46bn split almost equally between Norway and the UK.

Europe is the world's biggest offshore producer – operating some 438 fields and producing some 6.5mn b/d of oil and 20bn cf/d of gas. In the next five years development of oil and gas reserves totalling 14bn boe is expected in this huge area stretching from the arctic to the Mediterranean. The lion's share will be in the UK sector (7bn boe) and Norway (5bn boe), with the remaining 2bn boe divided between seven other countries' offshore areas.

The report also forecasts that the period to the end of 2004 will result in the installation of 152 fixed platforms, 17 floating production systems, 724 subsea well completions, over 3,000 km of control umbilicals and nearly 11,000 km of pipelines and flowlines.

Dr Roger Knight of Infield Systems commented: 'Fundamental change is underway - offshore Europe is now a mature region dominated by prospects for large numbers of small fields.' In the period 1995-1999, reserves totalling 26bn boe were bought onstream by 186 field developments, an average of 142mn boe per field. But for 2000-2004, there are 315 field prospects with reserves of 14.4bn boe, an average of 45.8mn boe. The greatest number of these, 122 (39%), are being considered for development as subsea satellites. A further 100 (32%) are expected to be developed by fixed production platforms.

In Brief

in block K4a of the Dutch sector of the North Sea. First gas is expected at end-2000, from an already-drilled exploration well. Four further wells will be drilled and put into production between 2001 and 2004. Production is expected to average 1.5mn cm/d at the start of 2001. All gas has been sold to Gasunie.



PanCanadian's H-08 appraisal well on the Deep Panuke natural gas discovery offshore Nova Scotia is understood to have tested at more than 50mn cf/d of gas. The company reports that testing confirms the Deep Panuke gas field as 'the most significant discovery in Atlantic Canada in more than a decade.'

BHP is understood to have stated that the ultra-deepwater Mad Dog and Atlantis fields in the Gulf of Mexico will come onstream in 2004. The Typhoon prospect is due to start-up on 2001.



Iranian authorities are reported to have announced the discovery of the Homa gas field in the south of the country. Reserves put at up to 6.7tn cf of gas and 82mn barrels of liquids.

Saudi Arabia is reported to be seeking foreign investors to develop the Haradh and Kidan-Shaybah gas fields in the east and southeast of the country, and the Rabigh Industrial City and Midyan area field development project on the Red Sea coast.

Italian energy group Eni is reported to have joined forces with Petropar of Iran to develop phases four and five of the South Pars gas field which is estimated to contain some 12tn cf of gas reserves.

The Burhan field in Oman came onstream in June, reports Stella Zenkovich. First production of 11,400 b/d of oil is expected to rise to 24,500 b/d by year-end and to peak at 37,000 b/d thereafter. Oman's Mukhaizna field has also come onstream, with production forecast to reach 25,000 b/d of oil by the end of the year.



Shell is to transfer its 60% stake in, and operatorship of, the Temir production sharing contract (PSC) onshore western Kazakhstan to Maersk Oil for

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In Brief

an undisclosed sum. The PSC is located to the west of the large Zhanazhol, Kinkyak and Alibekmola oil fields and contains the Saigak oil discovery.

Russian oil company Rosneft is reported to be planning to consolidate its Sakhalin portfolio by taking over its subsidiary Sakhalinmorneftegaz's 23% stake in the Sakhalin 1 project, as well as its interests in Sakhalin 3 and Sakhalin 4 where exploration recently began on the Astrakhanovoskoye structure.

Tyumen Oil Company is reported to have reached agreement with Canadian Ivanhoe Energy to acquire its share in the joint venture Tura Petroleum. The deal will boost Tyumen's stake in Tura's small operating Kalchinsky oil field in Western Siberia from 50% to 100%.

Shell is reported to planning to discuss with Gazprom the possible development of the Zapolyarnoye oil and gas field in Russia.

Lasmo is understood to have sold its entire 35% stake in the producing Nebit Dag concession onshore Turkmenistan to partner Burren Energy for an undisclosed sum. The deal boosts Burren's share in the project to 60%. ExxonMobil holds the remaining 40%. Nebit Dag is currently producing 8,000 b/d of oil, a figure that is forecast to rise to 15,000 b/d in 2001.

Lukoil has reached an agreement with TotalFinaElf to acquire a 20% stake in the 330mn barrel Kharyaga PSA in Timan-Pechora, reports the United Financial Group's Russia Morning Comment. The field currently operates at less than 10,000 b/d, but UFG predicts this will rise to peak at 90,000 b/d.

Tyumen Oil Company has embarked on the full-scale rehabilitation programme for the Samotlor field following the issuance of \$295mn in guarantees from the US Eximbank, reports the United Financial Group's Russia Morning Comment. According to Tyumen, workovers of high water cut wells by Halliburton – one of the leading contractors – will increase output of the 350,000 bld field by between 4% and 5% per annum.

Asia-Pacific

BP has placed an order for the construction of two new LNG ships with Samsung Heavy Industries in Koje,

Oil companies take US Government to court

E *Wupstream*

Chevron and Murphy Exploration & Production have filed a lawsuit against the US Government, claiming that it had denied the companies 'timely and fair review' of plans, permits and an appeal concerning an abundant natural gas field in the eastern Gulf of Mexico. The proposed natural gas project is centred on federal offshore leases in the Destin Dome 56 field. The US Department of Energy puts potential reserves at up to 2.6tn cf of gas.

The project is pending a decision by the Department of Commerce. Last year, the Environmental Protection Agency stopped processing environmental permits for the project, stating it would not resume work until the Department of

Petronius onstream

The Petronius oil and gas field in the Gulf of Mexico has come onstream. Current production is reported to be 8,700 b/d of oil and 6mn cf/d of gas. An additional three pre-drilled wells are to be brought online over the next few months, boosting output to 40,000 b/d of oil and 35mn cf/d of gas by October 2000. Further wells will enter production during the rest of 2000 and 2001, pushing production to 50,000 b/d and 70mn cf/d.

The \$500mn Petronius development consists of a compliant tower structure with production and drilling facilities set over six pre-drilled wells. The tower is said to be the first of its kind in the world, using flexible piling to provide resistance to hurricanes. The tip of the tower's vent boom is more than 2,000 ft above seawater, claimed to make it the world's tallest free-standing structure.

Field partners are Texaco (operator) and Marathon, each holding a 50% stake in the project. Commerce had rendered its decision. However, the Department of Commerce announced last month that it would not render a decision on the project until the EPA completed the environmental permits. The field partners allege that this regulatory 'Catch-22' situation constitutes breaches of lease contracts between the government and the partners and a 'taking' of property rights as protected by the Fifth Amendment of the Consitution.

The suit seeks compensation for lease bonuses and rentals paid to the government, exploration costs, environmental studies' expenses and development plans, and opportunity costs associated with the project.

Woodside profits up

Australian independent Woodside Petroleum has posted a net profit of A\$436.5mn (\$255mn) for 1H2000 compared with A\$123.8mn a year earlier. The result was boosted by the sale of a 10% stake in the Greater Sunrise fields in the Timor Sea for A\$104.2mn. The company has also announced plans to resume oil exploration in the North West Shelf joint venture area offshore Western Australia, in which it holds a 33% interest. Plans include exploration near the currently producing 115,000 b/d Cossack-Wanaea fields and drilling of the Castor-1 Well near the undeveloped Dixon field.

Woodside is also planning to drill 17 exploration wells this year in a bid to offset a forecast decline in liquids production from the Laminaria field and the North West Shelf. In addition, the company has committed to drilling three wells that could tie back to the Legendre field in the Carnarvon Basin offshore Western Australia.

Building a better future for UK oil and gas

The UK Department of Trade and Industry (DTI) has commissioned two new studies to identify £1bn in new business opportunities for oil and gas companies by 2010 in support of the Pilot initiative which aims to secure a long-term future for the sector. Ecotec Research and Consulting is to carry out the first study that will concentrate on the opportunities for growth presented by current environmental regulation. The second study, by Optimat, will explore how oil and gas companies can diversify into other sectors. In addition, Shell and BP have announced backing for a joint UK DTI/Pilot initiative to promote greater understanding between companies in the UK oil and gas sector. It is planned that larger operators will task key staff with mentoring industry SMEs in order to help the SMEs develop a strategic view of future industry needs. The initiative will also give larger organisations a much better insight into the challenges facing SMEs who provide many of their supplies and services.

NEW_{upstream}

BP sells some North Sea assets

BP is planning to sell some of its UK southern North Sea gas assets to Ireland-based independent Tullow Oil for £201mn in a cash-only transaction, subject to approval from the UK Government, the European Commission, licence partners and Tullow shareholders. The sale is designed to meet EC requirements for BP's takeover of Arco.

Tullow is to take over Arco's equity in the Thames, Wensum, Yare, Bure, Bure West, Deben, Welland, Orwell, Gawain, Hewett and associated gas fields, the Murdoch and Boulton gas fields, some undeveloped satellite fields and exploration acreage. Also included in the sale is Arco's stake in the Thames field pipeline, the Hewett field pipeline and the Caister-Murdoch system pipeline, as well as its interest in the Phillips-operated gas processing terminal at Bacton.

Net Arco production from the producing fields in the sale to Tullow amounts to a current average of almost 150mn cf/d of gas, with net remaining proved developed reserves at the end of 1999 of 228bn cf.

Faroese announce licensing round winners

A total of seven licences were granted to 12 oil companies in five groups in the Faroe Islands first licensing round. Four of the licenses were granted for a six-year period, and three for nine years. All cover acreage located southeast of the Islands.

Amerada Hess and partners in The Faroes Partnership were awarded licence 001, covering parts of blocks 6005/20 and 25, and 6004/16. Amerada Hess will act as operator, holding a 42.957% stake. Partner BG International holds a 39.960% interest,

South Korea. The order, worth in excess of \$300mn, also incorporates options to purchase a further three vessels. Construction will start in April 2001, with delivery of the first vessel in 4Q2002, the second in 1Q2003.

A natural gas discovery with estimated reserves of 65mn cm of gas is reported to have been made in China's Nanpi County in Hebei Province.

Thailand is understood to be offering 87 onshore and offshore blocks under its latest licensing round.

PTT Exploration and Production of Thailand is understood to have taken a 10% stake in the Southwest Vietnam Project offshore Vietnam's Songkhla province in exchange for a 20% interest in the Gulf of Thailand Arthit field which is being developed by Unocal and Mitsui Oil Exploration.

Vietnam Oil & Gas and Anzoil are reported to have discovered a gas field in the Red River province of Thai Binh in Vietnam. The field is located just 7 km south of the Tien Hai gas field. Reserves are put at 3.7bn cm of gas. DONG 16.983% and Atlantic Petroleum 0.100% (with options to increase at a future date).

Licence 002 went to a consortium of Agip (93%) and Faroese company Foeroya Kolvetni (7%); licence 003 to Statoil (35%), Phillips (30%), Enterprise (20%) and Veba (15%); licence 004 to BP Amoco (100%); licence 005 to Agip (93%) and Foeroya Kolvetni (7%); licence 006 to Statoil (27.5%), Anadarko (27.5%), Phillips (20%), Enterprise (15%) and Veba (10%); and licence 007 to Anadarko (100%).

Chevron is reported to have been given approval to develop the Jarmjuree field located in block B8/32 offshore Thailand. Located close to the already producing Benchamas and Maliwan fields, the B8/32 concession has proven and potential reserves of 3tn cf of gas and in excess of 350mn barrels of oil.

The Brunei Government is reported to have commissioned Petroleum Geo-Services to undertake what is claimed to be the largest 3D seismic survey in the world to date. The non-exclusive, 10,000 sq km 3D seismic survey is to cover the offshore deep waters of the southern area of the Exclusive Economic Zone and is expected to complete in 2Q2001.

OMV is reported to be planning to bring the Sawan field in Pakistan onstream in 2H2002. Field reserves are put at 2tn cf of gas.

Woodside Energy is reported to have agreed to acquire BP Amoco's 16.67% stake in the Egret and Dixon oil discoveries and 16.67% of the company's future oil discoveries in the North West Shelf Venture (NWSV).

In Brief

Petronas' Alab-1 well in the Samarang-Asam Paya production sharing contact area offshore eastern Sabah state has tested at 4,700 b/d.

CNOOC is understood to have begun development of the Dongfang 1-1 field offshore the west coast of Hainan Island. Field reserves are put at 90bn cm of gas in place. Dongfang is forecast to be producing 1.6bn cm of gas by 2003.



Repsol YPF reports that the Caruana field, located in the Potiguar Basin offshore Brazil, has come onstream. The field is forecast to produce over 30,000 b/d of oil by 2004.

Pemex is reported to have increased output from the Mexican Cantarell field by 27% compared to last year and is expected to reach 1.65mn b/d by the end of the year.

Santa Fe Snyder is understood to have brought onstream the Carauna field in the Potiguar Basin offshore Brazil. Field production is expected to peak at over 30,000 bld of oil by 2004 once it has been fully developed.



The Algerian Government has given Sonatrach and Amerada Hess its approval for two production sharing agreements covering development of LC 40 block in Rhourde El Bouni and enhancing production from the El Gassi, El Agreb and Zotti oil fields, southwest of Hassi Messaoud. The two projects, valued at \$550mn, include a 1,000-km 3D seismic acquisition programme, the drilling of 36 wells and the construction of gas facilities and a gas pipeline.

ABB, together with US company Petrofac International, has secured a \$574mn order from BHP Petroleum to design and build a natural gas processing plant for the Ohanet gas fields in Algeria. The plant will produce 30,400 b/d of condensate, 27,700 b/d of LPG and 665mn cf/d of pipeline quality gas. The facility is due to be commissioned in 2003.

Shell is reported to have made a new oil discovery on its Soku field onshore Nigeria. Reserves are put at between 70mn and 100mn barrels of oil. First production of 10,000 b/d is expected by October 2000.

In Brief

NEWS_{dustry}

UK

BP has posted a 2Q2000 profit of \$3,610mn, a rise of 164% compared with the same period a year ago. The first half-year figure was up by 197% to \$6,317mn.

Lasmo has posted 1H2000 earnings of £126mn, compared with £12mn in the same period a year earlier.

John Wood Group is to acquire Houston-based Mustang Engineering. Wood Group is initially buying 80% of Mustang for \$112mn, with the remaining 30% being acquired over the next six years.

Shell has posted a 2Q2000 profit of \$3.15bn that is almost double that recorded a year earlier. The company has already achieved cost improvements of \$3bn annually, and states that is is well ahead of schedule towards its target of \$4bn per year by 2001.

The UK Government has announced investment of \$30mn to 'kick-start' the UK Emissions Trading Scheme which aims to cut greenhouse gas emissions in the country.



Legal final warning notes have been sent to the Spanish and French Governments by the European Commission, threatening them with action at the European Court of Justice over their failure to abide by European Union VAT rules, according to Keith Nuthall. Spain imposes a special low VAT rate on bottled LPG while imposing a standard rate on natural gas; the Commission claims that the same rate should apply to both products. France levies a lower rate of VAT on standing charges for gas supplies than for metered charges. Again, the Commission says that the same rate should be charged in both instances, under the EU 6th VAT Directive.

Statoil has posted a 1H2000 profit before tax of NKr16.8bn, and increase of NKr11.7bn from the same time last year.

Respol YPF has posted a 2Q2000 profit of euro 649mn (\$584mn), pushing 1H2000 profit up from euro 284mn in 1H1999 to euro 1.1bn.

Kvaerner is reported to have launched a NKr4.5bn (£348mn) hostile bid for its biggest shareholder, Aker Maritime.

BP unveils new global branding

BP Amoco has unveiled its 'new, unified global brand' and announced plans for a radical update of its retail sites worldwide. The revamp – which comes 12 years after BPs sites were last modernised and 20 years after the refurbishment of Amoco's network – is part of a major drive to boost the Group's worldwide retail business by more than 10% per year over the next three years.

The move to a single brand comes after a \$120bn series of mergers and acquisitions over the past two years, which has brought together the operations of British Petroleum, Amoco, Arco and Burmah Castrol to create a combined group with a market value of more than \$200bn.

The enlarged group is now to be known simply as BP, with the familiar BP shield and Amoco torch replaced by a new symbol depicting a vibrant sunburst of green, white and yellow. Named the Helios mark after the sun god of ancient Greece, the new logo is intended to represent dynamic energy in all its forms, from oil and gas to solar.

The new logo is to be 'rapidly introduced' at company offices, manufacturing plants and on correspondence. However, its appearance on retail pole signs will be phased to coincide with the updating of the company's retail network – some 28,000 sites around the world – which is expected to take four years to complete.

The first new service station sites are to open later this year in London, UK, and in Cleveland and Indianapolis in the US. Liveried in green, white and yellow, the sites will offer customers a 'radical new concept in refuelling and shopping,' claims BP. In addition to the sale of BP's proprietary cleaner-burning fuels and Castrol lubricants, a new BP



Connect service will feature in-store ekiosks where customers can check weather and traffic conditions, pay without cash or credit cards and call up directions to local destinations. The new sites will be partly powered by solar energy via panels forming a transparent canopy above the pumps.

BP is reported to have spent some \$7bn developing the new brand and plans to spend a further \$25mn a quarter in support of the brand change, mainly non-retail signage and additional advertising. The Group claims that the cost of revamping its service station network would be 'broadly in line with investment already earmarked by the pre-merged companies to upgrade their sites.'

Although BP will be the single global brand, the company intends to retain its Castrol lubricants branding. In addition, all the company's US sites east of the Rockies will continue to sell Amoco fuel products. It is also intended to retain the Arco brand and marketing strategy at its 1,800 sites on the US West Coast.

Russian consortium to bid for Onaco

Sibneft, Yukos and Stroitransgaz have joined forces to participate in the privatisation auction for an 85% stake in Onaco, reports the United Financial Group's *Russia Morning Comment*. While the terms of the consortium arrangement have not been disclosed, UFG believes that the companies aim to divide just Orenburgneft – the only upstream subsidiary of Onaco – and that the Orsk refinery will either be sold or transferred to one party. According to UFG, the division of Orenburgneft would be fairly simple to carry out, given that it holds a large number of smaller fields and its infrastructure is spread over the entire Orenburg region. 'Provided that the partners have equal stakes in the consortium, each would receive approximately 50,000 b/d of production capacity, which should increase Sibneft's output by 16% and Yukos' output by 6%,' comments UFG.

NEWS_{dustry}

UK energy statistics released

The UK Department of Trade and Industry has published provisional statistics showing energy production and consumption, and petroleum product prices in the three months to June 2000.

Production of indigenous primary fuels in the 2Q2000, at 70.5mn toe, was 0.2% higher than in the same period a year earlier. Production of coal and petroleum fell by 10.4% and 7.1% respectively, while production of gas rose by 20% due to increased exports and colder weather than in 1999 boosting demand.

Total inland consumption of primary fuels, including deliveries into consumption, during the 2Q2000 – at 53.7mn toe – was 3.7% higher than that recorded in the same period a year earlier. Consumption of coal and gas rose by 7.2% and 10.5% respectively, while consumption of oil and primary electricity fell by 0.8% and 15%. Total use of petroleum, including nonenergy use, in the 2Q2000 was 19mn tonnes, 1.8% lower than a year ago. Energy use was virtually unchanged (up just 0.2%) while non-energy use decreased by 10.3%. Total motor spirit deliveries decreased by 2.6%, with deliveries of unleaded petrol 5% higher. In the study period, unleaded petrol deliveries (excluding lead replacement petrol) represented 92.2% of total motor spirit deliveries, compared with 85.6% a year earlier.

Diesel fuel deliveries rose by 3.9%, while deliveries of other gas diesel oils, primarily used for heating purposes, fell by 2.9%. Fuel oil deliveries fell by 28.5%, continuing its decline as a source of energy for industry and electricity generators.

Deliveries of other products increased by 6.4%, with increased deliveries of aviation fuel turbine fuel (up 4.2%), burning oil (up 8.4%) and LPG (up 3.9%).

European LPG market blues

Europe's domestic LPG market accounts for 51% of all LPG consumption for energy use in the region, according to a new report from London-based analyst Datamonitor. However, this sector is also reported to have experienced the slowest growth rate in Europe's energy market over the past five years, increasing by just 0.9%. Furthermore, LPG demand is expected to remain virtually static to 2009.

This pattern has been predominantly due to the expansion of the natural gas network throughout Europe, claims Datamonitor, combined with often unfavourable government regulation towards LPG use and an archaic product image.

These effects have forced LPG distibutors to compete for a shrinking domestic customer base over the past decade. With LPG markets in rapid decline, distributors are under pressure to acquire their competitors' customers in an attempt to increase market share, comments the company.

Consequently, they have had to improve their product delivery and service offerings in order to target new niche sectors and expand market coverage.

For further information, contact Datamonitor on Tel: +44 (0)20 7675 7000, Fax: +44 (0)20 7675 7500.

Latin American asset swap

Repsol YPF is to take a 30% stake in Petrobras' 188,000 boe/d Refap refinery in south Brazil and a service station network selling 480mn I/y in Brazil, together with a 10% interest in the Albacora Leste oil field in the Campos Basin.

In exchange, Petrobras is to receive Eg3 assets in Argentina, including a refinery with a production capacity of 30,500 boe/d as well as over 700 service stations. Other assets belonging to Repsol YPF are currently under economic analysis and negotiations, with a view to a swap for an additional 5% stake in Albacora Leste.

Thai moves for BG

BG International is selling its 22% shareholding in PTT Natural Gas Distribution Company (PTTNGD) in Thailand to Tractebel of Belgium for \$9mn (350.9mn Thai baht) in cash. The deal increases Tractebel's stake in the company to 49%.

PTTNGD distributes natural gas to industrial estates in the Bangkok area and currently supplies 42 local industrial customers with over 12mn cf/d of gas. It provides transport capacity for a further 24mn cf/d.

BG also holds a 22.22% stake in Thailand's Bongkot gas field in the Gulf of Thailand. The field produces 550mn cf/d of contracted gas, supplying nearly one-third of the country's gas demand. Two further wellhead platforms are planned for the field, and the drilling of a further 42 wells.



ExxonMobil Chairman Lee Raymond has reported that the group's projected near-term merger synergies of \$4.6bn before tax are 65% higher than originally projected and have grown by 20% from the numbers announced last December.

Information integration and database management system solutions provider FAME has rebranded its Saladin energy division as FAME Energy.

Apache Corporation has reported a 2Q2000 net income of \$140.4mn, more than four times that reported in the prior-year period.

The Board of Directors of Anadarko has approved increasing the company's 2000 capital investment budget to \$1.5bn.

Chevron has posted what it claims is a record net income of \$1.116bn for 2Q2000, compared with a 2Q1999 net income of \$350mn.

Apache's 2Q2000 revenues are reported to have risen to \$488bn from \$246bn in 2Q1999.

Phillips Petroleum has posted a \$2.2bn rise in revenues to \$5.4bn in the 2Q2000 compared with the same period a year ago.



The European Bank for Reconstruction and Development (EBRD) is reported to be preparing a \$250mn loan to Gazprom, following on from its \$150mn to Lukoil earlier this year.

Output of gas in Russia is expected to decline by 2.4% this year according to a new report from the Russian Government.

Russia's three biggest oil and gas companies Gazprom, Lukoil and Yukos are understood to be planning to form a joint company to explore for and produce oil in the northern Caspian Sea. The new venture will be called Caspian Oil Company, each partner holding an equal share.

Gazprom has decided to proceed with construction of the Trans-Baltic gas pipeline, which is expected to enable it to reduce its dependence on transit through Ukraine.

In Brief

NEV/Swnstream

UK

Shell has unveiled plans to concentrate its energy trading operations through a new business called Shell Trading.

Kuwait Petroleum has created a dedicated international lubricants division – Kuwait Petroleum International Lubricants (KPIL).

Europe

The European Commission has approved a takeover of the Austrian petrol and solid fuel retailer and wholesaler the COKOWI Group by the Austrian oil company OMV and German sold fuel company Rheinbraun.

A merger of the leased tank container fleets of the Australian company Brambles Industries together with the Switzerland-based Ermewa has been approved by the European Commission, creating a joint fleet of 20,000 tanks for the transport of bulk raw materials and liquefied gases. The new company is expected to rival the industry's market leader Transamerica, reports Keith Nuthall.

Texaco has exchanged its Greek network of service stations and commercial assets for 80 Shell forecourts in the UK and its share of the Plymouth terminal, a joint venture with BP.

Repsol YPF and its affiliate Gas Natural have signed time-charter contracts with Spanish shipping companies E N Elcano and N F Tapias and Norwegian operator Knutsen for three vessels to transport 29bn cm of LNG from Trinidad and Tobago to Spain over a 20-year period.

Austrian company OMV is reported to be currently building six service stations in Bulgaria.

Shell is understood to be acquiring 21 service stations in the Czech Republic from DEA Mineraloel in exchange for 45 Shell outlets in western Germany.

North America

General Motors and ExxonMobil claim to have developed a 'highly efficient' gasoline fuel processor for fuel cell vehicles. GM plans a vehicle demonstration using the technology within the next 18 months.

Murco redeveloping UK forecourts



Murco Petroleum has extended its UK forecourt retail offering with the opening of four new Costcutter shops at service stations in Killay (Swansea), Chingford, Hythe and Taunton. Murco now operates 28 Costcutter branded store forecourt outlets, and plans to increase this to 35 by the end of 2000.

Murco plans to continue a redevelopment programme of its UK forecourt network, with larger shops offering a wide range of products and food to go. It is also looking to add a range of services and solutions to 'make the sites more of a destination' including the addition of more off-licences, ATMs and post boxes, as well as order/pickup points, in-store community and service kiosks, and acting as local distribution points for the growing home delivery market.

The oil company also offers its dealers a package under which it helps fund Costcutter shop developments. Any dealer considering such a development could receive support by way of capital investment, site evaluation, space planning, product ranging and merchandising.

Songo Songo deal

US company AES is to acquire TransCanada PipeLines 49% stake in the Songo Songo gas-to-electricity project in Tanzania, as well as assume overall project management responsibility.

The \$325mn project comprises the refurbishment and operation of five natural gas wells in coastal Tanzania, the construction and operation of a 65mn cf/d gas processing plant and related facilities, the construction of a 230-km marine and land pipeline linking the gas plant to Dar es Salaam, and the conversion and upgrading of an existing 112-MW power station in Dar es Salaam to burn natural gas, with an optional additional unit to be constructed at the plant.

DGSA shortage

Wincanton Logistics has reported that four of its employees have qualified as Dangerous Goods Safety Advisors (DGSA) The Transport of Dangerous Goods (Safety Advisor) Regulations came into effect at the end of December 1999 and require that any company transporting dangerous goods must have an appropriate number of certified DGSAs. The certificates last for five years, after which each Advisor has to be re-certified.

The UK DETR estimates that the minimum number of DGSAs required across the industry is between 7,000 and 9,000. However, with only 2,000–3,000 qualified DGSAs to date, there is a current industry shortage.

Repsol YPF agrees Uruguayan joint venture

Repsol YPF and Uruguayan authority ANCAP have ratified a framework agreement to analyse the joint participation in distribution of oil products in Uruguay. It is proposed under the agreement, that Repsol YPF and ANCAP will each take a 40% stake in Uruguayan company DASA, the remaining share to stay under the control of existing DASA shareholders.

The Uruguayan fuel market currently sells 1.8mn cf/y, of which 75% is petrol and gas oil, reports Repsol YPF. Distribution is via a 520-strong service station network, where DASA is the main operator, holding a 36% stake. ANCAP supplies 80% of the market through its refinery at La Teja. NEV Swnstream

Ofgem reviews UK wholesale gas sector

Ofgem has published a review of major gas trading arrangements in the UK. The review assesses the operation of the first phase of the regulator's reforms of wholesale gas trading arrangements – the on-the-day commodity market (OCM) and entry capacity auctions – and looks at the causes of high wholesale gas prices in recent months.

Ofgem reports that it is 'satisfied' that the OCM has worked reasonably well when compared to its predecessor and that this, combined with an incentives package for Transco, has reduced the costs of balancing the system from £10mn to £7mn between winter 1998/1999 and winter 1999/2000.

The review finds that the recent high wholesale gas prices have been driven by market conditions. There has been increased demand caused by unseasonably cold weather and large volumes of gas sold for export to Europe through the Bacton–Zeebrugge Interconnector to take advantage of higher European gas prices. Demand during April and May was at times 50% higher than the same period last year and, over the whole period, was 27% higher, with 20% of demand concentrated at Bacton. The impact of increased demand has been seen this week – the Interconnector is unavailable as a result of planned summer maintenance and wholesale gas prices in the spot market have dropped by 40%. Network constraints and the impact of summer maintenance on BG Transco's national gas transmission system have also contributed to the higher prices, comments Ofgem.

The review did not find any evidence of market abuse by companies, although it did highlight a number of weaknesses in the existing arrangements, including the commercial arrangements designed to ensure that companies balance their inputs and offtakes from the system each day.

The regulator also states that its does not believe that there is a workable alternative to the entry capacity auctions that can deal efficiently with the constraints on the national transmission system, and has therefore proposed to continue with the entry auctions. The regulator also announced that the next round of auctions will include an increase in the amount of capacity for sale in the monthly auctions and a reduction in reserve prices in the daily capacity auctions.

Further information can be found at www.ofgem.gov.uk

Refinery sale

Irish National Petroleum Corporation (INPC) is selling the Whitegate oil refinery in County Cork and the Whiddy Island oil storage terminal in Bantry Bay to US company Tosco Corporation. Tosco is to pay \$100mn to acquire certain assets of INPC, and of its subsidiaries Irish Refining and Bantry Terminals. Under the deal, Tosco is to operate both the refinery and terminal for at least 15 years and to establish its European headquarters in Dublin. No job losses are expected.

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Whitegate oil refinery

In Brief

TotalFinaElf is selling its 60,000 b/d Big Spring (Texas) oil refinery, its logistic supply and transport networks and fuels marketing supporting 1,700 Finabranded service stations to Alon Israel for an undisclosed sum.

Shell, BP and Caltex are understood to be proposing a joint venture to operate their US product supply and distribution networks. Each will retain their individual brands, service station networks and products.

Shell and Bechtel Enterprises Holdings are reported to be restructuring their InterGen joint venture, transferring the natural gas pipelines, storage and power generation assets of Shell's US affiliate Coral Energy to Intergen.

The US Federal Trade Commission is understood to have approved Texas Eastern Products Pipeline Co's purchase of the assets of Arco Pipe Line Company. The assets have been valued at \$318.5mn.



TotalFinaElf is to acquire an interest in and extend the Taweelah A1 power station and desalination plant in Abu Dhabi. The \$1.5mn project will raise the plant's electrical generation capacity from 225 MW to 1,350 MW and the desalination water capacity from 130,000 cm/d to 380,000 cm/d – making it one of the largest cogeneration power plants in the world.

Russia and Central Asia

Lukoil is understood to have commenced commercial operation of the Varandey oil terminal in the Barents Sea. The Russian oil company's 100% control over the terminal – which is designed to handle 100,000 b/d of oil – allows it to export crude from the region \$9/t more cheaply than through Transneft's pipeline network, comments the United Financial Group's Russia Morning Comment, as well as avoiding export restrictions and quotas imposed by the government.

Less than a month after a 12% increase in export tariffs, Transneft has been granted a 25% increase, reports the United Financial Group's Russia Morning Comment. The additional revenues received by the pipeline monopoly are expected to be used to

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NEV/Swnstream

finance construction of the 240,000 b/d Baltic Pipeline System.

Turkey plans to import 228bn cm of Iranian gas over 25 years from mid-2001, reports the United Financial Group's Russia Morning Comment. Initial volumes are 3bn cm/y of gas, rising to 10bn cm/y as Turkish demand reaches 50bn cm/y.

Fortum has put a \$10bn price tag on the Trans-Baltic pipeline, which it plans to build with Gazprom, reports the United Financial Group's Russia Morning Comment. UFG estimates that at least 35bn cm of gas will need to be transported through the pipeline in order to justify its tremendously high construction cost. The project will not be completed until 2010.

Asia-Pacific

Plans to build a \$2bn, 1,200-km pipeline to carry oil from Oman to India are reported to have been abandoned after the two countries decided the project was not viable.

Latin America

The Argentinian Government is reported to be planning to sell its 20% holding in natural gas utility Camuzzi Gas Pampeana.



Moroccan oil refiner Samir is understood to be planning to invest \$600mn over five years to modernise its refining plants and expand capacity from 8mn t/y to 10mn t/y.

Simon acquires tanker operator



Simon Storage has acquired bulk liquid distributor Norman Lewis (Tankers) based at Goole on Humberside, UK. Norman Lewis operates both road tankers and tank containers in mainland Europe and the UK.

Forecourt TV rolls out across UK

TotalFinaElf and Elf Oil UK have signed an agreement with Forecourt Television that is claimed will 'bring sound and vision advertising and entertainment to the petrol buyer.' Commencing immediately at 300 sites in London and southeast England, Forecourt Television will eventually install large, 52-inch screen TVs close to the forecourt shop entrance at 1,000 Total, Fina and Elf sites throughout the UK.

The Forecourt TV system uses digital satellite delivery to reach each site individually and allows the programme to be highly flexible in terms of copy rotation and regional targeting of commercials. Bose speakers will relay sound to each pump, allowing the motorist to both see and hear advertisements while filling their car with fuel.

UK Deliveries into Consumption (tonnes)

Products	†June 1999	*Jun 2000	tJan–Jun 1999	*Jan–Jun 2000	% Change
Naphtha/LDF	246,062	142,439	1,603,815	1,159,785	-28
ATF – Kerosene	840,506	925,077	4,459,828	4,758,302	7
Petrol	1,780,720	1,719,568	10,522,944	10,408,800	-1
of which unleaded	1,528,228	1,589,657	8,876,791	9,544,792	8
of which Super unleaded	29,182	30,342	171,903	200,725	17
of which Premium unleaded	1,499,046	1,559,315	8,704,888	9,344,067	7
Lead Replacement Petrol (LRP)	0	129,911	0	864,008	-
Burning Oil	178,570	188,944	1,946,022	2,012,556	3
Automotive Diesel	1,273,434	1,291,834	7,448,856	7,655,900	2.8
GasOil/Marine Diesel Oil	519,075	517,049	3,454,193	3,528,049	2
Fuel Oil	150,236	100,303	1,131,851	816,478	-28
Lubricating Oil	70,200	70,271	394,110	402,484	2
Other Products	683,443	656,867	4,277,012	4,146,919	-3
Total above	5,742,246	5,612,352	35,238,631	34,889,273	-1
Refinery Consumption	486,194	431,621	3,153,032	2,638,492	-16
Total all products	6,228,440	6,043,973	38,391,663	37,527,765	-2
† Revised with adjustments * Figures dated from Feb	2000 onwards are the fi	nal figures as supplied by re	porting companies. They are	a langer provisional figures	

North Sea – a province heading for decline?

The North Sea is now a province of stark contrasts, with record production but minimal finds. Governments are ever more supportive and helpful, but companies are rationalising assets and minimising expenditures. Production decline is just around the corner, reports *Chris Skrebowski*.

n 1999 just 22mn barrels of oil were discovered in the UK sector of the North Sea, according to IHS Energy (see p17), just 2.1% of the volume produced in the sector in 1999. The Norwegian sector was only better in relative terms – 340mn barrels discovered, 29.2% of production.

Last year, 1999, was undoubtedly a bad year for the North Sea. Its relatively high costs and mature status meant it was low on the major oil companies' priority list when it came to allocating slashed E&P budgets. The smaller North Sea producers – Denmark, Holland and Germany – fared little better. *Petroleum Review* has produced its annual listing of fields coming onstream this year, known future projects and possible projects.

The fact that our North Sea table lists large numbers of actual and potential field developments tends to conceal the fact that really only very small and marginal accumulations now remain to be developed. In the course of 2000 contracts have started to be placed for the development of Blake, Jade, Skene, Leadon, Kyle, Bladon, Halley (oil), Skiff and Brigantine (gas) in the UK sector. Conoco's Vixen gas field seems set to achieve some sort of record by moving from discovery to development in just over a year. The UK sector's largest undeveloped accumulation – BP's Clair – appears to be set for formal sanction in 2001, as does Shell's Goldeneye.

The problem is that all 2000's developments will not offset production decline in the older fields. The IEA's latest estimate that UK sector production will decline by 77,000 b/d in 2000 versus 1999. It currently predicts a rebound of 60,000 b/d in 2001 as the fields that have come onstream in 2000 reach their peak flows. However, judging from the experience of recent years, even this may be optimistic as project schedules are still slipping and any delay means there is more older field decline to make up.

The pattern is now becoming all too clear. Virtually all known UK discoveries of any size are now subject to some sort of development proposal. The UK Government has been tireless in developing initiatives and applying pressure



to hasten developments. The sad reality is that no more than 2,000 of the 10,000 fabrication workers laid off from Scottish platform yards this year stand any realistic chance of seeing new work in 2001. There is simply not enough work to support the remaining fabrication yards, particularly as most new developments will be subsea tie-backs to existing facilities.

The picture in the Norwegian sector is rather better. By luck or good judgement the Norwegian Government has ensured that the development programme ties in well with the capacity of the fabrication yards. However, Norway is rapidly heading for the same sort of production decline now anticipated in the UK sector. The IEA predicts output growth of just 23,000 b/d in 2001 and notes that some of the older Norwegian fields – Statfjord, Gullfaks and Oseberg – experience annual declines in the 15–20% range.

This year has seen the go ahead for Grane – the Norwegian sector's largest undeveloped accumulation – as well as for Kvitebjorn, Glitne, Tambar and Huldran – all projects involving major fabrication work. Norway has a number of significant developments to come, which means there will be a steady workflow for Norwegian yards. However, the volume is unlikely to be large enough for there to be much work for yards outside Norway.

It is important to note that North Sea discoveries are still being made. So far this year there has been Svale in the Norwegian sector and TransCanada's finds in the Dutch sector K12–K13 blocks. In the UK sector, Conoco has the Kappa discovery in block 15/29b-12 while a little earlier in the year Amerada Hess made the Rochelle discovery in block 15/27.

Current high prices are enabling oil companies to rebuild their balance sheets and start investing once more. The North Sea presents them with a particularly difficult challenge. It is an area of very limited political or tax risk, the environmental challenges are known and understood. The geology has been unravelled and costs have been greatly reduced. The problem is that only small accumulations remain, and the chance of finding large accumulations are now very slim. The question they have to ask is, are their scarce manpower resources better devoted to small, low risk North Sea projects or to large, high risk, high reward projects in areas such as West Africa?

Increasingly we are seeing companies rationalise their North Sea portfolios. This has led to the emergence and increasing importance of companies such as Talisman specialising in low cost end of field life projects. With increasing numbers of North Sea fields now in decline it is likely that many of the major oil companies will reduce their presence in the area leaving the field to the smaller operators in much the same way as they have in the US lower 48 states onshore.

As noted in last month's Editorial, already 98 out of 132 producing oil fields in the UK sector are in decline, with output falling steadily. Facts 2000, the Norwegian Ministry of Petroleum & Energy publication, reveals that of the nearly 50 Norwegian sector oil and gas fields in production around 17 are in clear decline, including the really large accumulations such as Statfjord, Oseberg, Gullfaks and Frigg. The official view is that UK production will not decline until 2001/02 and Norwegian in 2002. However, there are increasing indications that UK production probably peaked in the 4Q1999 or 1Q2000 and that Norwegian production will peak in 2001. It is just possible that Norwegian production actually peaked in 1997.

Norwegian oil production is expected

to decline steadily after 2001. It is interesting to note that the Norwegian publication *Facts 2000* actually graphs output declines (and rises), confirming that some of the large post-peak fields decline at up to 20%/y. Analysis of official UK Government 'Brown Book' production figures for the UK sector show that for fields once they clearly past peak/plateau ,output declines by between 8% and 12%/y, averaging around 10%/y.

This is the challenge now facing North Sea operators and governments – how to slow the decline rate in developed accumulations while finding and developing new fields and increasing the recovery from all accumulations.

Field name	Oil/gas	Block no.	Operator	Start-up	Oil reserves	Gas reserve	s Prod system	Peak prod. (yr)
ик								
Onstream 2000								
Beauly	oil	16/21c	Talisman	4Q-00	3mn b		horiz well to Balmoral FI	PS 10,000 b/d
*Bittern**	oil	29/1a, 21/1b	Amerada Hess	Apr-00	110mn b	80bn cf	Triton FPSO	60,000 b/d
Captain B	oil	13/22a	Texaco	end-00			plat.+18 well temp	85,000 b/d (+20 kb/d)
Chestnut	oil	block 22/2	Premier	4Q-00	15-30mn b		subsea horizontal well	
*Cook	oil/gas	21/20a	Enterprise	Apr-00	20mn b	15bn cf	subsea to Anasuria FPSO	initial 10,000 b/d, 20.000 b/d (2001)
*Curlew D south	oil	block 29/7	Shell	Apr-00	4mn b		1 subsea well	initial 15,000 b/d
*Elgin/Franklin	cond	22/30b 30c 29/5b	Elf	2000	744/123mn b cond	889/821bn.cf	PDO + wellh'd plat	216 000 b/d
Gannet E phase 2		21/30	Shell	40-00		server inter	1 subsea well	15,000 b/d
*W&NW Guillemot	**	21/24 21/29a	Amerada Hess	Apr-00	28mn h	100bn cf	Triton EPSO	33,000 b/d
Keith	oil/gas	9/8a	RHP	402000	9mn h or 15mn hos	17hn cf	subsea to Bruce	13 000 b/d (2001)
*Kingfisher phase	onigus	5/00	Shall	402000	Shirbor Ishirboe	12011 (1		10mn cf/d (2001)
*Kingfisher phase	2	20/2	Snell	Jui-00			1 subsea well	7,000 b/d
*Kyle (EVVI)		29/20	Ranger	May-00	35mn b		EWI via Petrojari FPSO 10,	000 b/d (4-5 months)
*NVV Bell	gas	49/23	BP Amoco	Jan-00	and an and the second second	94bn cf	subsea to Bessemer	initial 90mn cf/d
Shearwater	cond	22/30b	Shell	Aug-00	160mn b liquids	850bn cf	PDQ + wellh'd plat.	82,000 b/d (2001), 425mn cf/d (2001)
Skiff	gas	48/20a	Shell	Oct-00	0.2mn b liquids	290-330bn cf	Min facils plat. to Clipper	65mn cf/d (2003)
S Everest/Lomond	gas/cond	2/9, 22/10a, 23/21	BP Amoco	2000			subsea via CATS/Forties	
Vixen	gas	49/17	Conoco	Oct-00		117bn cf	subsea via Viking BD pla	t. 120mn cf/d
Onstream 2001								
Blake	oil	13/24a, 24b, 29b	BG	Aug-01	50-75mn b or 75mr	n boe	8 subsea to Ross FPSO	40,000 (2002)
Braemar	oil/gas	16/3c	Marathon	2001	15mn b	120bn cf	subsea to Brae B	5,000 b/d (2002), 10,000 mn cf/d (2002)
Brigantine A, B & C	gas	49/19, 49/18		Jan-01		280bn cf	2NNM plat. via Corvette	130mn cf/d
Halley	oil/gas	30/12b	Talisman	2Q2001	8-19mn b	20bn cf	2 ER wells from Fulmar	12-15,000 b/d (2001), 15mn cf/d (2003)
Jade	oil/gas	30/2c	Phillips	4Q2001	40mn b (cond)	450bn cf	steel plat. via Judy/CATs	16,000 b/d (2002), 188mp cf/d (2002)
Kyle	oil	29/2r	Ranger	Mar-01	35mn h		subsea via Curlew EPSO	22 000 b/d (2001)
Leadon	oil/gas	block 0/1/12 0/1/h	Korr-McGoo	2002	Julia	70.100mm h	subsea to Coupeo or EPSC	22,000 5/4 (2001)
Bland	oil	20/2 -	Retrobus	102002	15 40mm h	70-100mm b	subsea to dryphon of FFSC	5 35 000 b/d 6 10mm
blane	UII	50/3a	retrooras	1Q2002	13-40mm b		Phil PPSO, Phz Subsea 1	cf/d (Ph1)
Clair	OII	206/7a, 8, 9a, 12, 13a	BP Amoco	2004	263mn b	States in	1 or 2 fixed steel plat.	80,000 b/d (2005)
Goldeneye	gas/cond	14/29a, 20/4b	Shell	2004	15mn b	600bn cf	plat.	5,000 b/d (2003), 200mn cf/d (2003)
Harding area gas	gas	9/23b	BP Amoco	end 2003		appraisal	tiebacks to Harding plat	form
NUGGETS	gas	3/18c, 19a, 19b, 20a, 24a,	TotalFina	2002		500bn cf	subsea	150mn cf/d (2004)
Skene	oil/gas	block 9/19	ExxonMobil	early 2002	95mn b	540bn cf	subsea to Beryl A/SAGE	27,000 b/d (2004), 180mn cf/d (2004)
Probable develop	s							
Brora		19/19	Mobil					
Callisto North	gas	49/22	Conoco	2000		25bn cf	subsea tieback	20mn cf/d (2000)
Carnoustie		22/17	BP Amoco	2001	0.11mn tonnes		via Montrose	and the factor
Dolphin		22/18	BP Amoro		and the contract		the month ose	
Europa	das	49/22	Conoco	2000		107bn cf	subsea tieback	55mn cf/d (2000)
Jacqui	oil/gas	30/13	Phillips	2002	14mn b	90bn cf	subsea to ludy 101	000 b/d (2002) 50mp
	e'n gos			2002		20011 CI	Justice to Judy 10,	cf/d (2005)
Josephine	oil/gas	30/13	Phillips	2003	13mn b	95bn cf	subsea to Judy 8,	000 b/d (2003), 50mn
Kate	ail/and	22/226 202	Phillips	2001	20mp b	20hn cf	20 000 644 /2	CT/G (2003)
Kestrel	oil/gas	211/21	Shell	2001	o mino	2000 CT	20,000 b/d (2	1002), 15mn cha (2001)

Table 1: North Sea fields onstream in 2000 and beyond

continued overleaf ...

North Sea E&P

Field name	Oil/gas	Block no.	Operator	Start-up	Oil reserves	Gas reserve	s Prod. system	Peak prod. (yr)
Maclure	oil/gas	block 9/19	BP Amoco	2001	20mn b	30bn cf	subsea to Harding	15,000 b/d (2002), 20mn cf/d (2005)
Marcel/Bravo								201111 Circl (2000)
Mariner Ottor (Wendy)	hvy oil	9/11a	Texaco	2002?	100mn b		project on hold	20.000 h/d (2002)
Penguin	hvv oil	211/13	Shell	2007	30mn b	33bn cf	subsea to Brent	20,000 b/0 (2002)
Perth	oil	15/21b	Amerada Hess	2002	45mn b		subsea to Scott	20,000 b/d (2003)
Pilot	oil	21/27	TotalFina	2002?	77mn b			
Pine	block 16	/12	Lasmo	2004	10mp b	220bp.cf	wellb'd plat to Sheanwater	18 000 b/d (2008)
Funn	olivgas	29/44, 54, 54, 10	Shell	2004	401111 0	320011 CT	wein a plat. to shearwater	150mn cf/d (2008),
Sinope	gas	49/22	Conoco	2000		64bn cf	subsea tieback	40mn cf/d (2000)
Skua	oil/gas	22/24b	Shell	Jun-02	27mn b	20bn cf	subsea to Marnock	19,000 b/d (2002),
Skve	oil	211/23a, 23c	Shell	2001	20mn b		subsea to Dunlin	11.000 b/d (2002)
Solan/Strathmore		204/30	Amerada Hess					
Suilven		204/19	BP Amoco					
Possible dev's								
Alwyn North Trias			Total					
Appleton	gas/cond	block 30/11	BP Amoco				and the second second	
Arbroath/Montrose	eoil	22/17, 18	BP Amoco	20002	25 20mm h		Poss comp plat.	
Bedevere	das	48/14	Mobil	2000?	25-50mm b	150bn cf	wellhead platform	
Beta UK	gas	44/24a	TotalFina	2002		150bn cf	wellh'd platform to NL	70mn cf/d (2003)
Block 15/23	cond	15/23d	BG					
Block 16/26	oil buy oil	16/26a	Arco					
Brigitte	das	5/208	BG					
Cavendish	gas	43/19a	BP Amoco	2000		100bn cf	subsea to Trent	52mn cf/d (2001)
Cromarty		17/21 2- 4- 41		2001 02 0	-	3		155
ECA Phase II	gas	4//3b, 3c, 4a, 4b	BG	2001, 03, 0	6mn h	390bn cf	wellhead plat.	155mn cf/d (2006) 5 000 b/d (2001)
Enoch	oil/gas	16/13a	Petrobras	2002	12mn b	16bn cf	subsea to Miller or Brae	10,000 b/d (2003),
							and the second second	15mn cf/d (2003)
Forties satellites	oil	21/15a, 15b	BP Amoco	2001	15mn b		subsea to Forties	10,000 b/d (2001)
Gadwall	oil/gas	21/200	Shell	2002 2002	9mn b	7bn cf	subsea to Kittiwake	10.000 b/d (2002).
	5 3 55							7mn cf/d (2002)
Hoton	gas	48/6, 7b	BP Amoco	2001		190bn cf	wellh'd plat. to W.Sole	75mn cf/d (2002)
Inde NE	gas	49/19 110/13b 14 (\\)	Shell	2001		45bn cf	subsea tieback	50mn cf/d (2002)
Magnus NW	oil	211/7a, 12a	BP Amoco	2001	10mn b	oobii ci	subsea to Magnus	6,000 b/d (2002)
Merlin phase 2	oil/gas	211/23a	Shell			income the	one-well tieback	
Orca	gas	44/24a, 29b, 30	TotalFina	2002	20min h	250bn cf	wellh'd plat. tieback to NL	120mn cf/d (2003)
PEIK UK	oli/gas	9/158	IotalFina	2002	20mn b	3500h Cf	subsea to Beryl A	9,000 b/d (2003), 110mn cf/d (2003)
Penguin	oil/gas	211/13a(N), 14(N)	Shell	2001	75mn b	193bn cf	subsea to Brent	45,000 b/d (2003),
D. D. ande	-11	15/07	DLUII					110mn cf/d (2002)
Thebe	011 Class	15/27	Conoco	2001		74bn cf	with ECA Phase II	35mn cf/d (2002)
Tornedo	oil	22/23b, 28a, 28c	Shell	2002	30mn b	14011 01	with ECA Phase II	20,000 b/d (2003)
Whittle & Wollaston	gas	42/28a, 28b	BP Amoco	2002		180bn cf	wellh'd plat. to Cleeton	85mn cf/d (2003)
2000 and after								
G17-4	gas	G17	TransCanada Intl	2002	12bn cm			
Hanze	oil	F/2A	VON	2001	35mn b	58bn cf	steel grav plat., via A6/F3	38mn cf/d (2001)
K/IA K/4-BF	gas	J/3A, K/1A K/4A	Elf Petroland	2002 end-00		260bn cf	plat. subsea 15m	83mn ct/d (2003)
K/6-A	gas	K/6	Elf Petroland	2000		30bn cf	plat.	in chird (carry 2001)
K12-13	gas	K12, K13	TransCanada Intl		4-10bn cm		All and a started	
L1A-A	gas	L1A-A	Elf Petroland	2002	5bn cm	20hp cf	sat plat. L4PN	
L/4-F	gas gas	L/4A	Elf Petroland	2002		37bn cf	plat.	
L/4-1	gas	L/4A	Elf Petroland	2000		52bn cf	plat.	
L/8-P4	gas	L/5C, L/8C	Wintershall	2001		125bn cf	plat.	
P/9C	gas	P/9C	Ciyde	2001		14bn cm	plat.	
Possible dev's								
A&B Quad	gas	A/12A	NAM	2004			plat.	
Beta G/16A	gas	D/15 G/16A	NAM	2001		38bn cf	subsea	18mn cf/d (2002)
K/15-FE	gas	K/15	NAM	2002		30bn cf	plat.	55mm ch/d (2003)
K/2B	gas	K/2B	NAM	2001		86bn cf	plat.	17mn cf/d (2002)
K/2B-K/3A	gas	K/2B,K/3A	NAM	2001		260bn cf	plat.	DEmis after (2002)
K/4-E	gas gas	K/4A	Elf	2001		150bn cf	plat.	35mn ct/a (2002)
L/7-G	gas	L/7	Elf	2001		30bn cf	plat.	
K/7-FB	gas	K/7	NAM	2001		150bn cf	plat.	
N/7-FE	gas	N	NAM	2001		TUUDN CT	plat.	

Table 1: North Sea fields onstream in 2000 and beyond

	Summer of	and the second se		-	Oil second	Car record	Prod system P	eak prod. (vr)
Field name	Oil/gas	Block no.	Operator	Start-up	Oil reserves	Gas reserves	s Prou system r	can prou. (Jr)
K/8-FB	gas	K/8	NAM	2002		40bn cf	plat.	Contraction of the second
L/1A	gas	L/1A	Elf	2001		31bn cf	plat.	16mn cf/d (2001)
L/2-FB	gas	L/2	NAM	2001		96bn cf	plat.	
L/8-14	gas	L/8B	Wintershall	2001		50bn cf	subsea	
L/9-6	gas	L/9A, L/9B	NAM	2001		160bn cf	plat.	
L/9-7	gas	L/9A	NAM	2001		100bn cf	subsea	15mm of (1 /2001)
M/7-5	gas	M/7	Clyde	2002/3		91bn cf	plat.	45mn cf/d (2001)
Orca	gas	D/15, D/18A	NAM	2001		75bn cf	plat.	40mn cf/d (2002)
Q/4-8	gas	Q/4	Clyde	2000		69bn ct	plat.	34min civa (2000)
NORWAY								
Onstream 2000		Sectore in the sectore	e	100000	101 2126	20.000 000/d		
Aasgard B	gas	65066507	Statol	4Q2000	130mg b	0.8hp.cm	subsea tieback to Heidrun	
Heidrun North	oll	20/0 13	Norsk Hudro	Oct-00	340mn b	11.4hn.cm	nlat	93-124.000 b/d
Oseberg South	oil/gas	30/9, 12	Statoil	2H-00	95mn b	Theorem	two well tieback to Stafior	d N
Stattjord North	oil	22/0 21/7	Statoil	Aug-00	96mn cm (535mn h)	0.6bn.cm	subsea via Statfiord C	40,000 b/d
Sygna	00	53/3, 54/7	Staton	Augroo	Soferon (SSS ferb)	bibbit citi		(by end 2000)
Onstream 2001								
Garn West	oil/gas		Shell	2001			subsea to Draugen	
Roan South	oil/gas		Shell	2001			subsea to Draugen	
Glitne/Dagny	oil/gas	block 15/5, 15/6	Statoil	2001	25mn b	9.2bn cm, 1.2mn cm	Petrojarl FPSO	40,000 b/d
Ginnerbugity	omgus	51561 1515, 1515	Staton	264.0				(first 15 months)
Gullfaks sats ph2	oil/gas	34/10, 33/12	Statoil	Oct-01	371mn b	54bn cm	via Gullfaks C 34,	000 b/d, 4.8bn cm,
				and an	All out on The Y	1		0.5mn t NGLs
Huldra	gas/cond	30/2, 30/3	Statoil	Aug-01	17.4mn cm cond	19.4bn cm	partial process'g plat. 3.2br	r cm, 1./mn cm (cond)
Kappa	oil/gas	30/6, 9	Norsk Hydro	2001	3.5mn cm	5.5bn cm	to Oseberg?	
Ringhorne	oil/gas	25/8/10	Esso	2001	190-280mn b	2bn cm	subsea+w'hd plat via Balde	er and a second state
Snorre II (B)	oil	34/4, 34/7	Norsk Hydro	Aug-01	250-330mn b		subsea to Snorre TLP	108,000 b/d
Tambar	oil	block 1/3	BP Amoco	2001	45mn b		wellhead platform via Ula	
Tommeliten A	oil/gas	block 2/4	Statoil	2001	3.2mn cm	3.5bn cm + 0.3mn t	subsea	
Trym	gas	3/7, 8	Shell	2001	5mn b (cond)	2.3bn cm	subsea to Harald (Denmark	:)
Onstream 2002+								
Barden	gas	6305/7	BP Amoco			100bn cm	design, 20km Ormen Lange	2
Ebba	oil/gas	block 2/7-31	Phillips	2002	appraisal	appraisal	appraisal	
Fangst	oil	6507/3	Statoil				floater	
Fram/Gioa	oil/gas	35/11 35/9 36/7	Norsk Hydro	2003/7	280mn b+1mn t (con	d)46bn cm+7.2mn	floater via Troll C	
Freia	oil	2/12 (Nul) 5603/27 28 (DL	Amerada Hess	2002/3	2mn cm + 0.1mn t	0.4bn cm	NNM plat.	
Grane (Hermod)	oil	block 25/11	Norsk Hydro	Oct-03	705mn b (hvv oil) 1.8bn cm	PDO plat.	214,000 b/d (2005)
Kristin	gas	6406/2-3, 11	Statoil	2005+	250mn b liquids	40-60bn cm	semisub via Aasgard facilit	s FEED contract
								toKvaerner
Kvitebjorn	oil/cond	34/11	Statoil	2004	14mn b, 3mn b (cond)	54bn cm	steel plat. (Aker to build)	6bn cm/yr
Lavrans	oil/gas	6406/2	Statoil	2006	23.1mn t NGLs	73-83bn cm	subsea to Kristin	
Mikkel	gas/cond	6407/6, 6407/5	Statoil	2003	1.6mn am, 4.6mn am (cond) 19.5bn cm,4.7mn t GL	subsea to Draugen	
Nyk High	gas	6707/10	BP Amoco	2003+	40bn cm		FPSO?	and the second
Ormen Lange	gas	6305/1, 2, 4-5, 7-8	Norsk Hydro	2006	350-400bn cm		subsea to plat. in 250m?	20 yr plateau
Oseberg (extsn)	gas/cond	block 30/9	Norsk Hydro	2002	15-20mn b	10-12bn cm	subsea via Oseberg	
Siavn	oil/gas	block 16/7	Esso	2004	4.7mn cm (cond)	5bn cm + 1mn	t to Sleipner	
Skarv	oil	6507/5	BP Amoco	2003+	250-500mn b	30bn cm	floater?	
Skirne + Bygave	gas/cond	block 25/5	Elf	2002	0.9mn cm (cond) + 0.7	4.3bn cm + 2.6	subsea to Heimdal	
Snoehvit+ others	oil/gas	7120/5.6. 7121/4.5	Statoil	2005+	100mn b liquids	200bn cm (4 fields)	subsea to shore	
Soon	oil/gas	1120300 1120 10	Norsk Hydro	2003/04	315mn b	63bn cm	FPO or subsea	
STUI	oil	34/7	Saga	2002/3	14mn b		subsea 6,000 b/d	
Tune A (ex Draken)	nas/conc	30/8 30/ 5 30/6	Norsk Hydro	early-02	7mm cm/conid), 0.1mm t NGL	24-27bn cm	subsea to Oseberg D	
Turibane N&S	oil/gas	6407/1	Statoil	2006	15 0mm cm + 5 6mm + NGI s	28.7bn cm	subsea to Kristin	
Valo	astrono	block 25/4	Norsk Hydro	2001/2	20-21mn b (cond)	2.5-3.0bn cm	subsea to Heimdal	
Valball water injec	t oil/aas	block 2/8	RP Amoro	2002	additional 200m	nn b	15 well plat to ini	210,000 b/d
Valuation Glitan	oil/gas	block 15/9	Statoil	2003	12 1mn cm	1.8bn.cm	wellhead plat via Sleipner	C. 244-02-220
1/3/09	oil	block 1/3	BP Amoco	2005	30mn b	n.oon chi	w'hd or s'sea via Gyda or l	Jla
DEMANANT								
DENMARK								
Halfdan (EWT)	oil	5505/13	Maorsk	Feb-00	31 8mn cm		process platform	
Halfdan/Nana	oil	5505/13	Maersk	end-00	31.8mn cm		process platform	
2001 and after								
Adda	oil/gas	5504/8	Maersk	2001+	1mn cm	1bn cm	subsea to Tyra?	
Alma	das	5505/17	Maersk	2003	6mn b	30bn cf	plat. 4,000 b/d (200	4), 22mn cf/d (2004)
Amalie	gas	5604/26a	Danon	2000	13mn b	92bn cf	plat. 7,000 b/d (200	2), 42mn cf/d (2006
Fllv	gascond	5504/6a	Maersk	2001+	0.8mn cm	3mn t NGLs	NNM plat.	and the second se
Gert	oil	5603/27a	Maersk	2000	9mn b	7bn cf	plat. 6,000 b/d (200	01), 5mn cf/d (2001)
laor	oil/gas	5505/13	Maersk	2001+	0.8mn cm	2bn cm	NNM plat. to Dan?	and the second sec
1910		a	1997 A. 1997					

Sources: UK Government (Brown Book), Facts 2000 The Norwegian Ministry of Petroleum and Energy, Wood Mackenzie, Petroleum Review * Onstream ** Triton Project

Table 1: North Sea fields onstream in 2000 and beyond



The perils of forecasting

In late 1996, the International Energy Agency (IEA) produced a definitive report on future offshore oil production to 2000. Now half-way through 2000, it is possible to see that 2mn b/d are missing. *Chris Skrebowski* analyses the data.

n its 1996 report – Global Offshore Oil Prospects to 2000 – the IEA anticipated a 6.37mn b/d increase in offshore oil production in the 1995–2000 period. Of this total, 5mn b/d would come from non-Opec countries. This new offshore production was expected to account for 80% of non-Opec production growth in the period. The latest data, however, indicates that non-Opec offshore oil production growth will actually be well under 3mn b/d, a shortfall of 2mn b/d, or 40%.

Norld

The IEA report was done on the basis of a bottom-up analysis in which the projected outputs of individual fields was summed to give the anticipated production by country.

Table 1 tabulates the largest expected increases by country and compares them with the estimates from the latest IEA monthly oil market report. (This contains projections for full-year 2000 on the basis of first six-month actuals). As can be seen from the table, some estimates, such as those for China and Mexico, are remarkably close. Several more are broadly within acceptable ranges, some are slightly high - Azerbaijan, Congo, Angola and others slightly low - Australia, Brazil. However, the remaining areas -Norway, the UK and the Gulf of Mexico are quite spectacularly inaccurate. Worse, these are the countries anticipated to make the largest contribution and the inaccuracy is all in the form of a massive over-estimate of anticipated production.

As the IEA could reasonably be expected to have had access to the best available data, the fact that its projections for the three best-known and best-documented offshore regions are all spectacularly too high raises a number of important questions.

One possibility is that the IEA was far too optimistic about development schedules. However, the evidence is mixed. Of all the Gulf of Mexico and North Sea fields due onstream according to the report, all but a handful of very small accumulations have actually come onstream in the period. However, a significant number of projects have been delayed, sometimes by up to two years.

The next possibility is that rate of production build-up, which is ultimately related to development slippage, was too optimistic. There seems to be some evidence for this. Thus year 2000 actuals should, according to the IEA report, have been achieved in 1997 (Norway), in 1996 (UK) and 1997/98 (Gulf of Mexico).

Another possible explanation is that the speed of decline in mature post-peak fields was underestimated. Again, the evidence is mixed. In terms of individual fields (see **Table 2**), some have overperformed and some underperformed. In what is a very small sample, it is the post-peak fields, such as Brent, Snorre, Oseberg and Scott, that have recorded the largest shortfalls. However, Ekofisk, Statfjord and Gullfaks, also all post-peak fields, have done much better than anticipated.

The main conclusion appears to be that the attempt to build production profiles bottom-up from individual fields is extremely difficult with errors and misestimates accumulating very quickly.

However, bottom up analysis is arguably a better forecasting method than any other. The sheer number of variables and the speed with which they change means that to be useful this sort of analysis has to be regularly updated. Certainly within two years, probably within one if it is to retain credibility and value.

Although the IEA has not directly revisited the Global Offshore Oil Prospects to 2000 report, it has started to revise its projections for oil supply in 2001. The August issue of the monthly oil market report compares and contrasts current and previous estimates for many countries.

One of the consequences of the largescale manpower cuts in the oil industry over recent years is that few companies now have any real global planning capacity. All the companies are now heavily reliant on outside agencies of which the IEA is the most important for their forward planning. As we have shown regular updating is vital if the IEA's key reports are to be useful and relevant over an extended period. Another example being the excellent but now very dated 1995 report on the Russian oil industry.

Over recent years there has been a naïve confidence amongst economists and government energy planners that the oil will always flow. This requires good and timely data. Good generals with bad maps lose battles.

Country	1995*	2000*	2000**	Gain	Actual**
Norway UK Mexico US*** Brazil Angola Australia China Congo Azerbaijan	2,911 2,699 1,947 1,397 524 646 497 176 189 153	3,707 3,485 2,402 2,390 1,302 890 696 387 345	3,321 2,788 2,400 1,552 1,400 760 811 381 310 280	796 786 455 993 778 244 199 211 178 192	410 89 453 155 876 114 314 205 121 127
Total	11,139	15,971	14,003	4,832	2,864

Sources: * IEA Global Offshore Oil Prospects to 2000

** IEA Monthly Oil Report (July 2000), Wood Mackenzie North Sea reports, Facts 2000 Norwegian Ministry of Petroleum and Energy *** Oil only, in Gulf of Mexico

Table 1: Predicted and likely offshore liquids production 1995-2000 ('000 b/d)

Field	Country	1995*	2000*	2000**
Canterell	Mexico	878	822	1.650
Statfjord (+N & E)	Norway	634	255	320
Oseberg (+W,E)	Norway	499	496	265
Gullfaks(+W, S)	Norway	484	270	367
Ekofisk (+sats)	Norway	279	221	326
Snorre	Norway	196	186	168
Brent	UK	187	165	80-90
Scott	UK	180	140	65-75

Sources: * IEA Global Offshore Oil Prospects to 2000

** IEA Monthly Oil Report (July 2000), Wood Mackenzie North Sea reports, Facts 2000 Norwegian Ministry of Petroleum and Energy

by end year

Table 2: Individual field performances 1995–2000 ('000 b/d)

Discovery still lags production despite good 1999 results

Only limited data on reserves and discovery rates are generally available. IHS Energy (previously Petroconsultants) has built up an enviable reputation with its *World Petroleum Trends* publication for the provision of oil and gas exploration data in 150 countries over the last 10 years. This year's publication clearly shows that although 1999 was a good year for oil discovery only a very limited number of countries succeeded in replacing production by new discovery. Among the larger producers only Azerbaijan, Angola and Iran found more liquids than they produced in 1999.

espite a collapse in exploration drilling worldwide, 1999 was a good year for both oil and gas discoveries. One huge find in Iran - the 5-6bn barrel recoverable Azedegan field - accounted for nearly 30% of the total oil discovered outside North America in 1999. This made 1999 the best year for oil discoveries since 1991, itself distorted by a super giant condensate discovery in Iran - the 18bn barrel South Pars field. This success has been despite the dramatic downturn in global exploration drilling. Outside North America, new field wildcat (NFW) drilling in 1999 was down by over 30% on 1998 and 40% on 1997.

Excluding these two Iranian fields, the oil discovery rate in 1999 confirmed two trends observed during the 1990s. The first is that the global oil discovery rate is being maintained despite much lower levels of exploration drilling. The efficiency of the exploration effort has been increasing throughout the decade, with an average of 4.5mn barrels discovered for each NFW drilled in the second half of the decade, a 50% increase on the rate in the first half of the 1990s.

The story for gas is slightly different. The decade was dominated by the huge 1991 South Pars discovery of 436tn cf. But even apart from that, the rate of gas discoveries globally has consistently been higher than that for oil and the increase in exploration efficiency (in terms of gas discovered/NFW) in the second half of the decade – at 85% – was higher than that for oil.

A consistent trend during the 1990s has been the concentration of oil discoveries in just a few countries. Of the 95 countries in which oil was found during the decade, well over 50% was found in 10 countries. And these discov-

Country	NFWs	Liquids added (mn b)	Liquids prod'n ('000 b/d)	Liquids prod'n (mn b/y)*	Reserves replacement %*
Australia	74	109	508.7	185.8	58.7
Indonesia	52	316	1443	527.1	60.0
Brazil	45	353	1,131.3	413.2	85.4
Argentina	40	149	800.4	292.3	51.0
China	36	830	3,264.9	1,192.5	69.6
Egypt	24	27	812	296.6	9.1
UK	24	22	2,912.8	1,063.9	2.1
Oman	18	122	903.3	330	37.0
India	18	102	688	251.3	40.6
Poland	16	1	5.9	2.2	46.5

Table 1: Top ten wildcatters 1999

Country	NFWs	Liquids added (mn b)	Liquids prod'n ('000 b/d)	Liquids prod'n (mn b/y)*	Reserves replacement %*
Iran	4	5,000	3,715	1,356.9	368.5
Saudi Arabia	2	2,050	8,200	2,995.1	68.4
Angola	10	1,335	765.5	279.6	477.5
China	36	830	3,264.9	1,192.5	69.6
Mexico	14	752	3,308	1,234.6	62.2
Azerbaijan	5	700	279.3	102.0	686.2
Nigeria	7	405	1,888	689.6	58.7
Equat. Guinea	2	400	84.5	30.8	1,298.7
Brazil	45	353	1,131.3	413.2	85.4
Norway	14	340	3,018.6	1,163.7	29.21

Notes:

1. Excludes North America: comparable information not available.

2. China and Brazil appear in both lists. * Petroleum Review estimates

Table 2: Top ten finders 1999

eries have been concentrated in both the oldest and newest major petroleum provinces in the world – Iran and Saudi Arabia in the former category and deep water Brazil and Angola in the latter.

However, despite more oil being found, the world is continuing to find less oil than it consumes. Whereas from 1990-1994, 62% of produced oil was replaced by new finds, the replacement rate dropped to 53% in the second half of the decade. Also interesting is the reserves replacement ratio for the top 10 non-Opec producers. Despite the fact that, for this group, replacement rates barely changed over the decade, averaging around 68%, only Angola and Brazil have succeeded in replacing their production by new discoveries over the last five years. And the replacement rate was lowest among some of the biggest producers - Mexico, the UK, Oman and Colombia.

analysis

Asking the wrong question about oil reserves

Much publicity has been given to reports and calculations of the volumes of yet-to-be discovered oil. This is usually seen as some sort of indicator of the long-term sustainability of the industry. *Chris Skrebowski* analyses the various potential bottlenecks in the oil development chain.

t a time when global capacity is tight and prices very firm it is important not to overreact to the temporary lack of production capacity but to try to analyse the relative importance of the long-term and shorter-term threats to the industry.

To date oil crises have been the result of a failure to supply or the expectation of a failure to supply. In 1956 the Suez crisis closed the Suez Canal, effectively curtailing supplies of Middle East crudes to Western Europe. In the UK there was petrol rationing.

In 1973 the Arab oil embargo (following the Yom Kippur War) removed 15% of Middle East supplies. This, in turn, was shared out by the international oil industry to produce a 7% cutback in supplies for everyone, Oil prices doubled as a consequence and never reversed.

In 1979 the Iranian revolution and the subsequent halving of Iranian crude production produced the expectation of a supply crisis. In fact there was no supply shortfall as Saudi and other supplies were expanded to make up the shortfall. However, this did not stop Japanese oil buyers from bidding up to \$50/b for spot supplies nor did it stop oil prices doubling and remaining at the higher level.

New production flows from the North Sea and other non-Opec sources led to the price collapse of 1985. Since that date there has been no serious threat to supplies apart from the Gulf War, which produced a short-lived price spike but no actual reduction in supplies.

Now in late summer 2000 we have a genuinely tight supply situation that has the potential to become a crisis but may in the end be no more than a temporary high-price situation.

It is interesting to note that much publicity has been given to recent reports from the United States Geological Survey (USGS) together with Robertson Research, both of which suggest there are very large volumes of yetto-be-discovered oil.

In an important sense such calculations are of only limited relevance. What is important when attempting to identify future supplies are the two key bottlenecks – the finding rate and the development rate – and their relationship to the production rate (see **Figures 1** and **2**).

However, it is important to note that of the various numbers that are required for the calculations only the production rate can be measured with any real degree of accuracy or consistency.

Many people have attempted to calculate the point at which a province, country or region goes into irreversible production decline. It is an important calculation for companies and countries as well as for international bodies, such as the International Energy Agency (IEA), with an interest in the adequacy of future supplies.

Sustained production decline

The calculations are difficult and involve a very high degree of uncertainty. To date there is only limited experience of sustained production decline. It is seen in a number of small producers – Austria, France, Romania, Poland and a few others.

It is also to be seen in some major producing areas such as western Canadian conventional oil and US lower 48 production. It is also possibly occurring in Alaska and Russia, and is expected imminently in the North Sea.

Sustained production decline will occur in any region or country once the rate of output growth from new fields and pre-plateau fields is less than the decline rate of the post-plateau fields.

Globally the depletion rate is generally calculated to be around 3%. This means that to sustain the world's current 75mn b/d consumption habit, around 2.25mn b/d of new capacity is needed each year. Add in the long-term oil demand growth rate of 2% and the annual requirement for new capacity is 3.75mn b/d, or 5%.

The real impact of these requirements has been masked because, post 1974, Opec countries had underused capacity that could be used as an alternative to generating new capacity. This reserve of underused capacity is now virtually exhausted and may have to be partially recreated to give the system flexibility.

This means that the really relevant question is about flows. The questions that have to be positively answered is: 'Does the current rate of discovery and development support the required production flows?' and 'Are they large enough to offset the natural decline rates all postpeak fields are subject to as well to meet anticipated oil demand growth rates?'

There are three key stages in the development process – identification of the resource, discovery and evaluation, and finally development and exploitation. This is broadly comparable to a manufacturing process where raw materials are processed into intermediate or part-finished goods before being made into saleable items.

The availability of raw materials is an important criterion in determining the long-term viability of a manufacturing process. However, it is not the most important one, as it has little impact on the immediate ability to supply products.

Similar considerations apply to the oil and gas industry – the potential availability of undiscovered oil resources is a secondary consideration when compared with the discovery and development rates. It will, however, determine the viability of the industry in the longer term.

Stages in development

The nature of yet-to-be-found oil is that there is no direct way to determine the volumes available. All estimates are by their very nature an analysis not a measurement.

The range is very wide. Dr Colin Campbell is easily the most pessimistic with an estimate of yet-to-find conventional oil of 184bn barrels.

Robertson Research International has just completed a major study and estimates, or rather calculates, that the yetto-be-found reserves base is 864bn barrels compared with the 2,634bn barrels it calculates has been found to date. (Around 900bn barrels has so far been produced).



However, even Robertson's estimate pales in the face of the newly completed study by the United States Geological Survey (USGS). This report estimates the yet-to-find oil resource at 239–1,376bn barrels with a mean of 724bn barrels. This total has been calculated using complex probability calculations applied to a panel of experts' assessment of potentially productive basins.

In terms of the actual finding rate the only generally available estimates of the finding rate for liquids is produced by IHS Energy Group (ex Petroconsultants) in their World Petroleum Trends 2000 publication. According to IHS (see report p17) the world has been replacing only 62% of production in the first half of the 1990s and 53% in the second half.

With demand in 1999 averaged just under 75mn b/d, or 27bn b/y, this implies that around 16–17bn barrels of liquids were discovered in the year. It is interesting to note that this volume would represent 100% reserve replacement if the world were consuming just under 46mn b/d – the rate of global consumption in 1970.

In short, the world is still finding large volumes of oil but it is consuming oil even faster than it is finding it, a situation that is, ultimately, not sustainable. However, this level of shortfall would have to be maintained for a number of years with no sign of reversal before it became of serious concern.

The other key rate is the development rate. In the absence of crisis it tends to be assumed that the development rate automatically equates to the decline rate in existing fields plus the oil demand growth rate. It is driven by the find rate.

In broad terms this is what usually happens -- but what is concealed is the

From diagram above

Total remaining reserves in Production (Proven & Probable) 827bn b (Campbell)** 965*bn b (World Oil) 1016*bn b (Oil & Gas Journal) 1033.8*bn b (BP Statistical Review) 160.8bn b (OSGS) * May include known but undeveloped reserves ** Conventional oil only

degree to which this is met by the erosion of the system's spare capacity. This is effectively what has happened over the last year or so. A shortfall in investment caused by low oil prices in 1998/99 has eroded the world's spare capacity to very low levels. This is undesirable because any system run close to capacity tends to become unstable in that small production shortfalls become catastrophic because they cannot be made up elsewhere in the system.

Fresh investment flows will tend to remedy the situation until the point is finally reached when there are insufficient reserves in undeveloped or underdeveloped fields to create production flows that are greater than the production declines in the mature, post-plateau fields.

Many, if not most, of the world's producing fields were discovered a long time ago and are therefore likely to be at plateau or in decline. However, there is insufficient reliable data to come to

It is possible to develop a schematic to analyse the stocks and flows in the development of oil in the world or in any individual province. Here one has been done for the world and the other for the UK sector of the North Sea. The very wide range of both stock and flow estimates is indicated. conclusions about whether this is a problem or a curiosity.

The pessimists say it's a problem. The optimists say not. In the absence of a database strong enough to give a clear answer we will simply have to wait until the answer becomes clearer.

It is possible to identify two sorts of potential oil crisis. The first, and the one that has been seen to date, is the production/capacity crisis where the world demands more oil than is immediately available.

This can occur either because there is no spare capacity or holders of the unused capacity are unprepared to use it. If markets are allowed to operate freely higher prices will reconcile supply and demand and, over time, draw forth new capacity. This may be a smooth or a discontinuous process.

The second sustained capacity crisis could only occur if there was not enough undeveloped or underdeveloped oil fields to meet the requirement even with investment. It could also occur if for some reason companies could not access undeveloped or underdeveloped resources.

Prices would rise but if this did not stimulate new capacity then investment would tend to flow to competitive alternatives. Again the process could be relatively smooth or it could be socially and economically disruptive.



UK sector enters decline?

For the UK sector, the average finding rate over the last five years of 250mn b/y has represented 21% of the five-year average production rate of just under 2.8mn b/d, or 1.013bn b/y (see IHS article p17). According to the UK Government 'Brown Book' remaining reserves (proved and probable) at end-1999 were 1,120mn tonnes, or 8.4bn barrels.

However, *Petroleum Review* calculates from the Brown Book figures that, of this total, only 375mn tonnes, or 2.8bn barrels, are in fields that have not already moved into decline.

The Edinburgh-based consultant Wood Mackenzie estimates there are 4bn barrels of oil in known but undeveloped UK sector discoveries, but that only around 2bn barrels of this is likely to be economic to develop. This initial figure accords well with the Brown Book figure of 545mn tonnes, or 4.1bn barrels, of possible UK sector oil reserves.

Looking at the production flow analysis for the UK sector it is hard to escape the idea that a decline in output is imminent. The IEA, in its latest monthly *Oil Market Report* (August 2000), suggests a small decline in 2000 production and a small (60,000 b/d) rebound in 2001 – output in both years being below 1999 levels. All the indications are that a sustained production decline has now begun.

The impact of technology

Over the last 10 to 15 years the technology involved in the discovery and development of oil and gas resources has improved out of all recognition. It is important, however, to analyse how improved technology impacts the various stages in the development process.

The development and refinement of 3D seismic means that subtle traps and accumulations can now be positively identified. It is now even possible to determine if a structure is filled – although determining whether it is water or oil is difficult, gas can be clearly differentiated from liquids.

One of the most rapid areas of development has been offshore seismic acquisition. Multi-streamer arrays and ever more sophisticated vessels are leading to the very rapid evaluation of offshore areas. It is now much easier and faster to acquire offshore seismic than onshore.

The development of immersive environments (hives) for data evaluation has by all accounts improved the understanding of reservoirs and speeded the process of development planning. This, in turn, has allowed the more effective and intensive development of reservoirs. In short, it has facilitated the ongoing process of improving recovery rates.

In technological frontier areas, such as the North Sea, recovery rates are now frequently exceeding 60% (care should be taken with claimed recovery rates as production is certain but reserves are simply estimates). The ability to 'see' production in the reservoir by using 4D or time-lapsed seismic means that reservoirs can be produced much more efficiently and infill wells can be precisely targeted to maximise recovery. This process of improving recovery has been going on since pressure maintenance techniques were first applied. However, in recent years the pace of technological change has undoubtedly quickened. Possibly even more important, the cost of the technology has reduced dramatically.

Another area of technological impact has been the development of multiphase flow and, more recently, seabed separation. Both these enable long stepouts from existing facilities, allowing the development of small, remote accumulations.

Despite the way in which technology aids oil recovery it still remains true that once a field passes its peak and moves into the decline phase no amount of technology will enable production to reattain peak flows. Technology is certainly slowing decline rates in mature fields and/or helping to maintain plateau output for longer. It is also helping to reduce the cost of operating facilities which means that fields, particularly offshore, can be kept in economic operation at lower levels of output.

The other impacts of technology are to be seen in the transportation and refining sectors where losses are much lower than in the past. Conversion efficiencies show no clear pattern as yields of high specification products comes at a volume cost.

The final area of technological impact comes in use. Efficiencies of all fuel consuming units from vehicles to power stations have been subject to continuous and ongoing improvement. If oil products were used as inefficiently as in the 1950s there would have been an oil crisis long ago.

Rebuilding Iraq's oil industry

With 112bn barrels of proven reserves and 215bn barrels of estimated reserves, Iraq holds the world's second largest reserves of oil. Its oil industry dates back to 1927 and the discovery of the giant Kirkuk field. Yet, according to the former Iraqi Minister of Oil, Issam Al-Chalabi, in a paper presented at a recent Middle East Institute conference on 'Iraqi Oil After Sanctions', the country's oil industry has only enjoyed six years – between 1974 and 1980 – with sufficient resources and freedom to develop.

Mojgan Djamarani reports.

raq's oil production peaked at 3.5mn b/d in 1979 and has not reached that level since. It is against this background that the current state of the Iraqi oil industry, with the ravages inflicted upon it by first the eight years of war with Iran, and then the Gulf War and 10 years of sanctions imposed by the UN Security Council, must be viewed.

Recent history and UN sanctions

On 1 August 1990, the state of the Iraqi oil industry could have been summarised by the following statistics:

- production capacity of 3.5mn b/d;
- production expansion programme for 4.2mn b/d by year-end;
- export capacity of 5mn b/d;
- export expansion programme for 6mn b/d; and
- refining capacity of 700,000 b/d.

In contrast, in May 2000 the equivalent statistics were:

- production capacity of 3.1mn b/d;
- production expansion programme for 3.3mn b/d by year-end;
- export capacity of 2.5mn b/d; and
- refining capacity of 350,000 b/d.

Following the invasion of Kuwait and the embargo on Iraqi oil exports, oil production fell to 300,000 b/d. Iraq has since managed to raise production to 3.1mn b/d through the use of short-term techniques that would be shunned elsewhere in the international oil industry. UN Resolution 986, passed in 1995, began the 'oil-for-food' programme which allows Iraq to sell specified dollar amounts of oil over six-month periods. Two-thirds of the earnings are earmarked for purchases of food and medicine for the Iraqi people and the remainder are used to pay for war reparations, transit fees for the Turkish pipeline and part-funding of the UN Special Commission that seeks to dismantle Iraq's weapons capabilities.

Iraq is now in Phase VIII of the oil-forfood programme. The dollar amount of oil Irag could sell has been increased from \$2bn in Phase I to \$8.3bn in Phase VII. In the current phase, all restrictions on the amount of oil Iraq can produce and sell have been lifted. However, the country was only allowed to purchase spare parts and equipment for its oil industry beginning in Phase IV of the programme and, even then, only to the tune of \$300mn. The US has said that the money thus allocated should only be used for short-term improvements to Irag's oil industry and not long-term repairs. So far Iraq has received \$250mn worth of spares and equipment, although it has more than \$5bn in an escrow account and has submitted more than 1,000 applications for spares and equipment.

The US is blocking approval of contracts worth more than \$1bn on the grounds of their dual use nature. Last month (June) following a survey on the state of the Iraqi oil industry, commissioned by the UN Secretary General Kofi Annan, the Security Council increased the amount of money Iraq can spend on its run-down oil industry to \$1.2bn over a 12-month period.

UN Resolution 1284, passed in December 1999, calls for a fast-track approach to decision-making on spare parts by setting up a committee of experts that would consider Iraqi contracts and by-pass the US veto. But the US has been dragging its feet on the composition of the committee and the list of equipment as a means of pressuring Iraq to agree to the return of the UN weapons inspectors who left the country in 1998.

Increases in oil production have been achieved by causing, in some cases, irreversible damage to the reservoirs, thereby shortening their productive life. According to a 1999 report by Saybolt International, a Dutch consulting firm that monitors Iragi oil flow for the UN, Iraq's water injection programme to raise output has led to the watering out of 54 wells in the south of the country which are unlikely to be rehabilitated. It has also caused irreparable damage to 20% of reservoirs in the north of the country. Kofi Annan has warned of a possible break-down of the Iraqi oil industry if the Security Council continues to withhold spares and equipment.

The extent of the structural damage to the Iraqi oil industry is such that some believe that, even if parts and spares were released, production would at best only be stabilised.

Current status

Current oil production of 1.4mn b/d comes mainly from the country's two largest fields - Rumaila in the south and Kirkuk in the north. Rumaila suffered severe damages to its gathering centres and compression/degassing stations in the Gulf War. Indeed, in the north and central Irag, some 60% of the oil facilities were damaged by the war. Kirkuk, with 10bn barrels in remaining reserves, forms the basis of northern Iraqi production. It has been in operation for more than 70 years and currently produces 900,000 b/d, with the other northern fields - Jambur, Bai Hassan and Khabbaz - contributing another 300,000 b/d. The Russian oil company Zarubezhneft is planning to drill 100 wells in Kirkuk to raise production to 1.1mn b/d by the end of 2000.

Despite shortages of parts and equipment, Iraq plans to increase oil production to 3.3mn b/d by the end of the year. It hopes to do so by boosting production at the East Baghdad field in central Iraq to 150,000 b/d from the current 50,000 b/d, and at the West Qurna

Middle East Iraq



field near Rumaila to 200,000 b/d from the current 120,000 b/d.

Export facilities

The Gulf War disabled much of Iraq's export capability that had already been damaged in the war with Iran. Currently, Iraq has two operating export routes. One is the 600-mile, 40inch Kirkuk-Ceyhan pipeline, which is its largest operable crude export pipeline under the UN sanctions regime. It is operating at 900,000 b/d, some 200,000 b/d short of its full operational capacity. Iraq's other export route is its largest terminal on the Gulf, Mina al Bakr. It has four 400,000 b/d capacity berths capable of handling very large crude carriers. The Iragis have repaired most of the damage caused to the terminal which handles between 1.3mn and 1.4mn b/d of oil.

The 750-km pipeline from Kirkuk to the Syrian port of Banias on the Mediterranean has also been rehabilitated. The pipeline – which was shut down in 1982 by the Syrians as a show of solidarity with Iran in its war with Iraq – is now ready to begin operations with an initial capacity of 30,000 b/d pending a decision by the Syrian leadership. Iraq also hopes to complete repairs to two berths on the second of its three Gulf terminals at Khor al Amaya by the end of the year to provide export capacity of 70,000 b/d. The terminal was also damaged in the war with Iran.

Iraq will need Security Council approval for any exports from either the Syrian pipeline or the Khor al Amaya terminal since they are not part of the facilities where UN personnel are stationed to monitor the metering equipment and to ensure that Iraq is complying with the sanctions regime. The UN report on the Iraqi oil industry says that the Iraqis would not export oil through the Syrian pipeline until 2001.

To further expand export capacity, crude oil loading facilities are being added to a third terminal at Khor al-Zubair that generally handles dry goods exports.

Iraq's other export facilities, its 500,000 b/d, 46-inch pipeline designed to carry Basra Regular oil from Rumaila to Ceyhan and its Strategic Pipeline, remain disabled. The Strategic Pipeline consists of two parallel 700,000 b/d pipelines that carried Kirkuk oil south to the Gulf and Southern Rumaila to be shipped north through to Turkey.

Around 54% of Iraq's oil sales in Phase

VIII of the oil-for-food programme are contracted to Russian firms and some 24% to French and Chinese firms who, in turn, resell the oil. The US has become a significant importer of Iraqi oil with onethird of exports going there.

Oil exports were reduced in June and early July this year as the price of sour crude fell as result of depressed demand. The situation could become exacerbated if Saudi Arabia releases the 500,000 b/d it has pledged to add to the market to keep the oil price down since most of the additional production will be sour.

Plans in place

Iraq's post-sanctions plans include raising oil production to 6mn b/d within 10 years of the lifting of the sanctions, requiring some \$30bn in foreign investment. Plans also include upgrading refineries and constructing a new 290,000 b/d central refinery near Babylon and the construction of a 100,000 b/d pipeline to pump Iraqi crude to the Jordanian refinery near Zarqa instead of transporting it by trucks. There are also plans to begin exports of the country's non-associated gas to Turkey.

Most of the increase in production, according to Dr M Zainy, Senior Energy Economist at GCES, is envisaged to come from new developments rather than existing fields. Rehabilitation of the existing fields will also contribute to increased production but, he believes, to a much lesser extent than new developments.

Iraq has negotiated a number of agreements with foreign oil companies but, so far, has only signed two production sharing contracts (PSCs) with Russian and Chinese companies. Russian oil companies are in a strong position in Iraq because of the combination of longstanding political sympathy with Iraq together with Irag owing Russia billions of dollars for past, Soviet-era arms deliveries. Lukoil has signed a PSC for Phase II development of the West Qurna field with 15bn barrels of oil reserves. Similarly, China's National Petroleum Corporation (CNPC) has signed a PSC for the al Ahdab field in south Iraq. However, both contracts are pending the lifting of the sanctions, much to Iraq's chagrin.

The Iraqis have also negotiated PSAs for nine other fields – including an agreement with Elf Aquitaine and TotalFina (now merged) for the 10–30bn barrel Majonoon and 6bn barrel Nahr Umar fields; with Agip for the Nassiriyeh field with expected production of 300,000 b/d; and with BHP for the 5bn barrel Halfaya field.

Iraq is also offering service contracts for eight already producing fields in the south – North and South Rumaila, Zubair, Luhais, Subba, Abu Ghirab, Buzurgan and Fuqa fields. Already a number of US firms are involved in oil industry service activities which has raised criticism in the US and questions about US commitment to a change of regime in Iraq. Given that most of the Iraqi oil industry equipment and technology date from the 1960s and 1970s and were mostly manufactured in the US the increasing role of American companies is not surprising.

Iraq has also appointed Agip and Gaz de France to head a consortium to develop a \$2–3bn natural gas project. Iraq aims to sell 290mn cf/d of non-associated gas to Turkey from the Anfal, Chemchemal, Jeria-Pika, Khashim, Alahmar and Mansuriyeh fields.

Present sanctions regime

Any involvement by the foreign oil companies in upstream development is dependent on Iraq's cooperation with UN arms inspectors. Under the sanctions regime the UN Secretary General must appoint a committee of experts to make recommendations on the role the foreign oil company should play in the Iraqi upstream sector. The recommendations must then be approved by the Security Council and can only be implemented after Iraq has cooperated with UN weapons inspectors for a consecutive 120 days. The process will then be reviewed by the Security Council every four months and, if Iraq fails to cooperate, the foreign oil companies activities will be suspended.

It is unlikely that foreign oil companies will risk billions of dollars in investment on such terms and conditions, especially as many oil producing countries in the Middle East and elsewhere are opening up their upstream oil operations to foreign investment and can offer less risky environments.

Opec relations

Earlier this year, Iraq had requested to be brought back into the Opec production quota system at 3,4mn b/d. According to Dr Zainy, Iraq's intentions might be politically motivated to gain some leverage on the other members since it is unlikely that the Iraqis, given the poor state of their oil industry and its erratic production, can meet the ceiling that might be allocated.

In the longer term, however, Opec membership will not be advantageous to them as they may not want to be constrained by its production quotas. Although more oil on the market will mean lower prices, Dr Fadhil Chalabi of GCES, at the Middle East Institute Conference last February, argued that Iraq can win with this strategy because its production costs are much lower than many other oil exporters.



Petroleum road tankers fire resistance of mudwings

There have been a number of incidents where the tyres on petroleum tankers have caught fire, often caused by failure of a wheel bearing or binding brake. A tyre fire can threaten the integrity of the cargo tank and its contents unless sufficient protection is provided to give time for the emergency services to reach the incident and deal with the fire. In recognising the need for an industry standard for fire resistance of mudwings, which are seen as a means of shielding cargo tanks from fires, the Institute of Petroleum's Road Tanker Panel commissioned Warrington Fire Research to develop an appropriate test procedure and to subject samples of existing mudwings to trial.

A period of twenty minutes is understood to be the minimum needed to give time for fire fighting assistance to arrive at the scene of an incident in the UK. This publication therefore not only details the method of testing developed by Warrington Fire Research (WFR TP 002) to test these requirements, but also publishes the results of testing a number of mudwings, including 25 colour plates.

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North Sea profile

North Sea prospects looking good

Petroleum Review recently talked to John Brooks (right), Director and Head of Exploration and Licensing at the UK Department of Trade and Industry (DTI). He believes that the North Sea, although often called a 'mature' province, still has significant reserve potential and is very much 'alive and kicking'.

QYou have been professionally involved with the North Sea from the very start. Can you briefly describe your roles and the events that gave you the most satisfaction and any areas where you think the UK Government could have acted differently or more effectively?

A ljoined the DTI in 1973 and am currently in charge of exploration and exploration licensing on the UK Continental Shelf (UKCS). Although marginally involved in the 5th and 6th licensing rounds, I became heavily involved from the 7th licensing round onwards, right up to the most recent 18th round. My role is to promote exploration activity and investment in the UK and to ensure that licence awards are made in a timely and proper manner.

The UK Government has been very consistent in its regulatory approach to the UKCS over the years. While taxes may have changed a little, by and large, the overall regulatory regime remains very close to the one originally laid down by the UK Government in 1964. I believe this is one of the reasons, together with the wide and diverse range of opportunities it offers, why the North Sea sector is so strong - it has been in the Top Five on Robertson Research's annual survey for the past five years. It is a good thing to be consistent - oil companies don't like uncertainty, and new entrants to the market are attracted if they know exactly what they will get.

QYou are a geologist by training. The North Sea is both fascinating and very challenging for geologists. Do you ever regret becoming a civil servant rather than a geologist?

At am a civil servant who happens Ato be a petroleum geologist. Nevertheless, I don't think I could have done my job without my geological and business experience. I had 10 years in industry, working first as a geologist in the geophysical and contracting industry for three years, then with Gas Council Exploration (now BG) and then Amoco. It is important for me to be in tune with what both the major and small players are doing and what they need. In fact, I spend a great deal of my time talking with companies, especially new players.

I don't regret joining the civil service at all. I have thoroughly enjoyed it. The civil service is a great place to be – it is flexible and full of talented people, many of whom are not afraid to tackle things in a new way. It gives you the chance to really make a difference.

QTabulating the figures from the various 'Brown Books', *Petroleum Review* calculates that this year will probably see the start of the long-predicted decline in UK sector oil output. Of the 144 fields currently in production, around 100 are already in decline, including virtually all of the older fields. Have you any comment?

Well, 1999 was another record year for UKCS oil and gas production so we're doing something right. But we must not be complacent. Such a decline will happen if we don't explore. And therein lies the problem - there is not enough exploration being done at the moment to replace reserves. There have been lots of discussions about whether the North Sea is 'mature' or not - this is an unfortunate choice of word. While there are geological horizons in the North Sea that have seen a great deal of production, other prospective reservoirs are under-explored and hold great potential. As an illustration, recent discoveries have been made in subtle Tertiary and Lower Cretaceous traps. And we have not even started to look under the Carboniferous rocks in the Southern Gas Basin or at deeper horizons in the Central and Northern North Sea.

We need to look at the North Sea with new 'spectacles' – using 21st cen-



tury imaging techniques that allow us to see with remarkable clarity, even under salt. The obvious discoveries have been found and now we need to think laterally, to find the more elusive traps. There is a lot more out there to find – we have to better define the potential in currently producing basins and how we can get at it, as well as exploring new areas, for example, the prospective Atlantic Margin.

Qover the last year there have been a number of UK Government initiatives designed to stimulate North Sea activity. Which do you believe has been the most effective?

A number of initiatives looking at Ways of bringing clusters of North Sea accumulations onstream are currently being developed by companies and the PILOT scheme (formerly the Oil and Gas Industry Task Force, OGITF). Options for the development of fallow discoveries are also being discussed under the DTI's recent Fallow Blocks initiative.

I have personally derived the most pleasure from the LIFT (Licence Information For Trading) programme that puts companies with deals to make and acreage to offer on the web, providing industry access to UKCS information and opportunities from anywhere in the world. We were the first government to promote such a programme, and others are now following our lead. As a Task Force initiative, the DTI has helped to progress the LIFT project supplying online licence data that was integrated into the website designed by Schlumberger. LIFT has been well received by current licensees and acts as a vehicle for new players to enter the UKCS. It is an initiative that very much looks to the future.

QIn light of the court ruling last November regarding the European Union Habitats Directive, what is the UK's current position regarding the offshore environment?

A The ruling was that the Habitats Directive applies to the continental shelf. We are now in the process of putting in place the measures needed to apply the Directive to offshore oil and gas activities.

It is the Oil and Gas Directorate's responsibility to ensure that the environment is properly considered both before petroleum licences are awarded and throughout their term. There is already a great deal of environmental information collected on the UKCS in surveys for wells and fields, and regional studies conducted by oil companies, academia, NERC (the National Environmental Research Council) and the British Geological Survey. We need to pull all this information together, synthesise it and move forward to add information where it is necessary, without duplicating data unnecessarily. Ongoing dialogue with the NGOs will help to make this a dynamic discussion with interested parties.

The environment is a highly emotive issue. We need a sensible and pragmatic approach to the environment and exploration, running side-by-side.

Q In your long career in the Ministry, what do you regard as the achievement that has given you the most satisfaction?

A the current team of regulators is the best I have ever had – the people are absolutely motivated, they turn things around quickly and efficiently and know exactly what to do. I am proud to have played a part in building this team. This can't be done in a moment, it has taken much time and effort on everyone's part.

Seeing people 'grow' gives me great pleasure – taking someone with potential, supporting their development and keeping them onboard for a long time. Some of the team has been with me for over 20 years!

QYou are about to retire in the relatively near future. What are your plans and would you like to remain involved in the oil and gas industry?

A have not retired yet! I am still Actively promoting the UK and hope to be involved in the next licensing round. Whatever I end up doing when I do retire, I like to think that I will still have the energy and drive to make a contribution to the UK and industry in general – I am happy to do this in whatever way I can. I have no firm plans in this respect as yet, although I am due to join the Institute of Petroleum as a Senior Member of Council in the near future.

I also plan to revise the text of the Dictionary of Geology that I cowrote with Doug Whitten. It was first published by Penguin some 30 years ago. Although many of the definitions, such as rock types, remain the same, concepts in geology and oil industry technology have undergone immense change over the past three decades. For example, plate tectonics is not included in the book as it was still a relative new concept at the time!

Talking of change, our industry has gone through much 'turmoil' in recent years, which has put many young people off entering this sector. We need to bring them back onboard, otherwise the expertise won't be there for industry in the future. I would be very happy to become involved in education programmes to promote the oil and gas industry to young people.

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Technology subsea

Setting sights on total subsea production

'We are going to re-engineer the North Sea - we'll do this sub-surface, on the seabed and on the surface. Imagine a future where platform integrity, downhole and surface control is possible from shore - all our technical experts connected in a virtual network.' That is the vision of Dick Olver. **Exploration Chief Executive** at BP, echoing the aims of the whole offshore industry. 'It's all about innovation, technology and automation,' he adds. Neil Potter looks at some of the signposts along the road to this brave new world.

Petronic' – that's the new academic discipline which many consider to be the pathway to this future in offshore developments. It is described as the science of improving recovery using systems technology and cybernetic methods combined with flow and production techniques.

The aim is to produce a whole new generation of multiskilled geologists, geophysicists, petroleum engineers, reservoir engineers, production engineers – indeed, everyone involved in exploration and production – all with special skills in such areas as computing, automation and electronics wizardry.

Total subsea production

Professor Michael Golan of the Institute for Petroleum Technology and Applied Geophysics at the Norwegian University of Science and Technology is currently pursuing a research programme in cooperation with Norsk Hydro and ABB which focuses on production optimisation and automated control of wells and pipelines. It is hardly surprising that these two companies are supporting this approach, for they are among the leaders in the drive towards total subsea production with processing onshore. That ultimate goal is becoming intriguingly closer.

This year, the \$32mn Troll pilot subsea separation system, Subsis – supplied by ABB with pumps and injectors from Framo and the wet mateable electrical connector from Mecon – began operations (see *Petroleum Review*, February 2000). Initially the system received a wellstream of just under 24,000 b/d from the S-13 well and separated it into 16,350 b/d of oil and 7,550 b/d of water. Half of the water produced was sent to a dedicated reinjection well. Now, with the installation of the injection pump which has a capacity of 38,000 b/d, all the water is reinjected.

Gorm Gundersen, Head of ABB's Oil, Gas and Petrochemicals division, says that the success of Subsis technology 'is the first step towards our vision of offshore oil and gas production running from the seabed directly to shore.'

On Troll, Subsis is installed in 350 metres of water. ABB is now studying the development of subsea processing systems down to 1,400 metres. It says that the global market for subsea processing is growing – especially in the North Sea, the Gulf of Mexico and off the west coast of Africa – and is expected to grow to between \$500mn and \$600mn a year within the next few years.

The success of Subsis is vital to the future development of the total subsea production scenario and its progress is being watched by many other operators. It could be one of the key elements in the development of the giant gas/condensate Ormen Lange field,



where Norsk Hydro is operator for the development phase and Shell will be the production operator.

The schedule is for the concept selection to be made in 2001/2002, with submission of the PDO (planned development option) at the end of 2002 and first production in late 2006. Norsk Hydro's favoured option is for a complete subsea-to-land system with the wells manifolded at the reservoir, linked to the subsea facilities at the foot of the Storegga Slide (which was formed some 7,000 years ago), with the pipeline climbing up it from 850 metres water depth to 250 metres and then up again to the onshore plant.

Bengt Lie Hansen, Senior Vice President at Norsk Hydro, says the environment challenges, apart from the water depth, include low seabed temperatures of -2°C, waves of 31.5 metres, arctic winds and currents, and a very uneven seabed with some blocks of compacted clay measuring 50 metres high.

'There are technological challenges too,' he says. 'This is particularly so for subsea separation and much will depend on the success of Subsis. The challenges include subsea controls and flow assurance, and there may be a requirement for future compression.'

One of the problems to be solved is the fact that the step-out distance for Subsis is, at the moment, only 10 km. But Ormen Lange is 130 kms from the shore.

Clearly electrical power is an essential part of the subsea system. Here, ABB continues work in enhancing its Sepdis (subsea electrical power distribution system) technology, which has a stepout distance of up to 60 km. The company has received significant funding from the partners in Ormen Lange, that will enable it to expand the scope of the work, particularly in developing a new connector that will result in increased capability. The aim now is to have the qualification of all the major components completed in 1Q2001.

Phased development

Another Norsk Hydro project that will utilise a subsea processing system is the phased development of the Sogn area, which comprises the Fram, Fram West and Gjoa fields. It has been decided to submit a PDO for Fram West in North Sea block 35/11 by Christmas. Conventional subsea facilities will be utilised, with the oil and gas sent to the Troll C platform via a 24-km pipeline. First production is scheduled for October 2003.

However, the partners have decided that the eastern reservoirs of Fram – the Gjoa reservoirs – should be developed with subsea facilities rather than platforms, with Fram due to come onstream in 2005 and Gjoa, which is 40



km to the north, in 2006. This will pro-

vide time for the development of the subsea equipment required for threephase separation and, particularly for Gjoa, solve the challenges of hydrate formation and power transmission over long distances. Several major offshore suppliers in Norway are now carrying out studies focusing on these issues.

Subsea systems under development

Kvaerner, which has a tested a clutch of compact modularised cyclone separation packages for different well fluid compositions, is also carrying out studies for Sogn. Demo 2000 has granted Kvaerner Eureka funds to be used for marinising, testing, verification and documentation of a subsea wet gas compressor/multiphase pump module (SMPM) suitable for application on Sogn. Kvaerner says that verification of the SMPM design, based on data from Sogn, is the main goal of the project. The programme calls for detailed design to be completed in 2002, manufacturing, procurement and assembly to be carried out through 2000 to 2003, followed by testing in 2004.

Aker Maritime, in partnership with a number of component manufacturers, is progressing a complete subsurfaceto-land system. At the same time, it has applied, with RWE-DEA as operator, for the relinquished licence for block 35/3 to the north of Sogn. This contains the small Agal gas field discovered in 1980. The partners believe that a subsea development tied back to an onshore processing plant would make this a viable development.

Alpha Thames Engineering, now 75% owned by Swedish submarine fabricator Kockums, has developed a simple subsea separation module – AlphaPrime – that it calls 'an off the shelf solution.' It claims each module (they are installed in pairs) can process 20,000 b/d. The module slots into place at two connecting points on the wellhead using a conventional wellhead connector. The company is now keen to get support from operators and to construct a test model.

Over the past four years the development of H-Sep, the downhole horizontal gravity separator developed by Norsk Hydro, Kvaerner Oilfield Products and Weir Pumps, has been closely monitored by the industry (see *Petroleum Review*, February 2000). Earlier this year a prototype was successfully tested at Norsk Hydro's R&D facility at Porsgrunn, south of Oslo. Early next year, the company will drill a production well in Brage, 13 km from Oseberg, and install the separator for field trials.

Norsk Hydro says that, apart from the economic and environmental benefits of the system, it is possible to transport virtually pure oil (WC (water content) less than 0.5%) to land over long distances and at great depths without major problems with hydrate formation in the pipelines. Simultaneously good injection water (OIW (oil in water) content less than 500 ppm) is produced.

Overall, the complexity and variety of the technological challenges facing the industry and the suppliers are wideranging, encompassing subsurface and reservoir technology, longer subsea tiebacks, drilling and well completions through tubing rotary drilling, seabed and downhole processing, deepwater technology, composite risers, to mention but a few.

Driving forces

The immediate drive is to improve production from mature fields, the economic development of marginal fields and general cost-cutting. From 1990 to 1997, technological advances were responsible for additional reserves of 5.8bn boe in the UKCS. Now it is realised that there is a need for advanced technologies and techniques. Developing them, it is estimated, could make an additional 5.6bn boe economic.

Technology

The industry is well aware of the challenges it faces in the UK. An Industry Technology Facilitator, David Ellix, has been appointed within Pilot – the successor to the Oil and Gas Industry Task Force (OGITF). In Norway, Demo 2000 was initiated last year. Both are cooperatives between the industry, government, supply companies and research institutions. Both have the same goal – fast-track technology from conception through design, prototype to installation offshore. The number of Demo 2000 industry projects now totals 42, with a total value of around NKr550mn.

The utilisation of fibre optics is spreading into various sectors. BP has recently linked Valhall and Ula to Stavanger via a fibre optic cable and this summer linked Forties, Everest, Lomond and Ula to Aberdeen. 'This,' says Olver, 'opens up many possibilities – to things we can currently conceptualise, and, I believe, much we yet cannot.'

Going downhole

Increasingly, there is a 'need-to-know' what is actually happening in the well and in the reservoir. In the UK, Sensor Highway has launched a new facility in Aberdeen and re-styled itself Sensa, following an injection of £8.25mn by two, one US and one UK, venture capitalist companies. It is utilising fibre opticbased sensing technology to provide continuous, real-time 'down-the-hole' measurement, with its Distributed Temperature Sensing system. With the potential to reduce operating costs by up to 10%, BP has installed it in an extended reach well on Wytch Farm and a well on Harding, while BHP installed the system on a Douglas well in Liverpool Bay to monitor ESP (electrical submersible pump) performance. Shell has installed a system on the Tern platform and plans to utilise it in subsea wells in 2001.

ABB has developed a Downhole Fibre Optical Gauge System (DOGS) for reservoir pressure and temperature monitoring, that has been tested on a live well offshore Brunei. This is an integral part of ABB's Advanced Downhole Monitoring and Reservoir Control system. Individual system elements and full system testing were scheduled to be completed in mid-2000. ABB is now looking for an operator so that field trials can be conducted.

Meanwhile, the Read Group has a project, with Demo 2000 support, to further develop a seismic acquisition



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sensor installation

system to be permanently installed downhole. This can be used for 4D seismic imaging and passive listening to the micro-seismic reservoir activity during field production, providing information that can be used for controlling injection and optimisation of oil recovery.

subsea

Experiments on Ekofisk, conducted by Phillips, have shown that use of permanent installation of monitoring microseismic activity can provide extra detail in mapping smaller faults not seen on surface seismic data. The project is an extension of one originally supported by Saga, Norsk Hydro and Statoil.

The objective now is to analyse and evaluate the downhole acoustic noises generated by the production flow; to evaluate the use of fibre optics; and to expand the downhole system to accommodate a larger number of sensor packages. The sensor elements will be installed as an integral part of the well completion.

To combat the influx of sand - the bane of production engineers - ABB has developed a compact concentric cylindric cyclone, known as 4C, which is said to be novel in that it combines sand removal and gas/liquid separation without any moving parts. It utilises moderate gravity forces to make the internal flow path geometry suitable for these functions. It features one cylindrical unit placed inside another, where the outer cylinder serves as pressure containment and volume buffer. Special emphasis has been put on smooth handling of the oil/water mixture to avoid severe droplet break-up and stable emulsions downstream of the cyclone.

Raising recovery

Looking further ahead, Statoil, in cooperation with other operators and supply companies, is developing with assistance from Demo 2000, a wellstream compressor that will raise pressure in the pipeline and boost recovery by 10–15% of gas and condensate. It is planning to apply this technology to new developments based on placing production equipment on the seabed rather than on a platform. The company is studying the possibility of installing one of these new compressors in the Mikkel gas discovery, where production could begin in 2002–2003. The field could be tied back over 35 km to the subsea installations on the Midgard portion of the Asgard field.

Figure 3: Typical platform well - single

FIBRE OPTIC

CONNECTOR

PRESSURE &

SENSOR

PACKER

TEMPERATURE

Subsea installations featuring a wellstream compressor will require a lot of power – as much as 10 MW. It is proposed that an umbilical from land will supply the compressor with power, but also with lubricants and control signals.

After a cost study this summer, a small scale-model will be constructed for testing at the Karsto treatment complex. If everything is successful in these trials, a full-scale unit will be built and placed on the Sleipner T platform and then under water on Mikkel. Statoil expects the compressor to be ready for use by 2007. This will be around the time when Mikkel would require compression. Other candidates could be an alternative to a new compressor platform on the Sleipner fields, Snohvit in the Barents Sea and Ormen Lange.



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Production potential of methane hydrate

In March 1998, a test well drilled by Japanese National Oil Company (JNOC) and the Geological Survey of Canada in the Mackenzie Delta encountered 3.7tn cf of gas. Rather than rushing into production, however, the well was sealed and abandoned. Why? Because the gas encountered was methane hydrate, one of the most tantalizing – and mysterious – sources of potential energy in the world. Gordon Cope reports.

For years, hydrates held this rather esoteric, far-out fascination as a key factor for greenhouse emissions, submarine landslides, or as a hazard causing drilling rig fires,' comments Scott Dallimore, a Research Scientist with the Geological Survey of Canada. 'It's only been in the last few years that scientists have begun to seriously evaluate hydrates as an energy source.'

Methane hydrates are a naturally occurring mixture of gas and water. Typically, a single methane molecule sits within a cage of six water molecules to form a white, crystalline solid. Most hydrates form offshore in deep ocean sediments or onshore at shallow to moderate depths in Arctic permafrost regions. As upward migrating thermogenic and biogenic methane encounters near-freezing temperatures, it bonds with water to form hydrates. Stable methane hydrates are found near and beneath the sea floor where water depths exceed 300 to 500 metres. They are also stable in permafrost conditions encountered in Arctic regions.

Estimates of the amount of methane hydrates vary widely. The US Geological Survey reckons there are 700,000tn cf of methane in gas hydrates worldwide – which would potentially exceed the combined international reserves of conventional oil and gas, coal and oil shale.

Not all methane occurs in concentrated deposits, however. 'Most methane hydrate deposits are low in concentration and high in areal extent,' comments Dallimore. 'Fortunately, Canada is well-endowed with highly concentrated gas hydrates.'

The concentrated deposits show up as bright spots on seismic. One such deposit, located 70 km north of Inuvik, was targeted by the 1,100 metre Mallik L-38 test well, drilled in the spring of 1998. The research well. to evaluate hydrate designed drilling/coring and completion technologies in hydrate-rich sediments, encountered approximately 150 metres of methane hydrate. 'Scientific studies suggest that the Mallik hydrate deposit is very concentrated, containing as much as 3.7tn cf in just this one field,' says Dallimore. 'There may be dozens of other fields just like it in the Mackenzie Delta-Southern Beaufort Sea area.'

Looks good on paper

However, finding hydrates is one thing – getting it out is a different matter. For the last several years, lab scientists have been working on ways to commercially produce methane hydrates.

The separation of methane from the water molecules is relatively simple – you increase the temperature, decrease the pressure, or alter the reservoir chemistry by introducing antifreeze.

In reality, many questions remain about the kinetics of hydrate dissociation and the development of safe, economic means of producing methane from hydrates.

A technical paper presented at a recent CERI conference in Calgary – Comparative Assessment of Natural Gas Hydrate Production Models, by WK Sawyer, CM Boyer, J Frantz and T Mroz – summarised the various theoretical methods of exploiting methane hydrates.

One of the simplest models for producing methane involves drilling through hydrates that form a cap above a conventional natural gas deposit, and removing the gas. As the gas is depleted, the hydrate cap de-pressurises, and the methane is slowly released downwards into the conventional deposit.

A second de-pressurisation technique, involving fracturing, was also considered. First, the hydrate deposit is fractured using an injection of salt to establish and maintain a high permeability, ice-free flow path. The hydrate is then attacked using a super-saturated calcium chloride brine.

Steam injection has also been proposed for hydrate production. A frontal-sweep, steam injection pattern would allow significant production, but only if the reservoir had high, insitu permeability and a porosity of at least 15%. The thermal injection technique would require approximately 10% of the energy released to function successfully.

In conclusion, their study showed that all of the models examined indicated that production of gas from solid hydrates would require a large number of producing wells, handling of considerable water volumes, and large amounts of energy input.

A pain in the gas

Unfortunately, the high cost of infrastructure is not the only obstacle. Ed Fercho is Vice President of Canadian Petroleum Engineering, and the Drilling Superintendent who oversaw the Mallik well. 'Hydrates can be a problem if you don't understand what you're dealing with,' he explains. 'It can degenerate and blow-out and scare everybody half to death.'

Drilling the Mallik well itself was no difficult task; Fercho relied on years of experience in the Beaufort to prevent any mishaps. 'You chill the mud and keep the cuttings encapsulated until you can set casing with good quality permafrost cement,' he notes.

Complications may arise when attempts are made to commercially exploit the hydrate reservoir, however. 'It could be a real mess,' says Walt Sawyer, a Production Engineer with Schlumberger-Holditch Reservoir Technologies. 'There are a lot of practical production problems to resolve.'

Many hydrate deposits, for instance, are located in unconsolidated media near the sea bottom; a mix of mud, sand and organic debris. 'The hydrate reservoir may have high permeability and porosity in its undisturbed state, but (when it is penetrated by production wells) it can turn to mud when it melts, or it can freeze up if it gets too cold,' says Sawyer.

Research programmes

In order to solve some of the problems, several nations around the world have on-going hydrate research programmes. The US Department of Energy's plan, which recently earmarked up to \$47.5mn over the next five years for research into methane hydrate, is typical of the efforts.

The first order of international research is to look at available information, such as logs, cores and drilling records. Lab work will also be done to establish *in situ* physical characteristics. 'The great bulk of research is based on pure methane hydrate systems, not water/gas/sediment systems,' says Dallimore. 'We have to improve our knowledge of hydrates in sediments.'

Other research will look at exploration techniques. 'We have to improve our geological models and geophysical exploration tools, like seismic.'

Finally, scientists need to advance the technical side of production, by experi-



Hydrate in sand and gravel

menting in the field with de-pressurisation and/or chemical and thermal systems. 'We hope to return to Mallik and do a full-blown production test by 2002,' says Dallimore.

Bringing hydrates

onstream

If, over the next five years, the major stumbling blocks to hydrate exploitation are resolved, where will the first commercial production occur?

Some experts think that the Japanese will be the first to produce methane from hydrates commercially. The island, which is bereft of conventional petroleum resources, is surrounded by deep seas in which conditions are ideal for hydrate accumulation. Three offshore test wells have already been drilled into concentrated methane hydrate zones. 'I think that, if they find the right deposit, they will attempt to produce it within the decade,' comments Thomas Mroz, a Geological Engineer with the US Department of Energy's National Energy Technology Laboratory.

Others disagree. 'The technology for producing offshore deposits is daunting,' says Dallimore. 'It will take more time to reach the commercial development stage.'

Dallimore believes the most likely situation for commercial production will be onshore permafrost in the Arctic. 'We have already delineated the reserves in Canada and Alaska. It will likely be associated with a site with both hydrates and conventional gas – once the technology is developed, hydrates could just be treated as another zone that you add to your conventional production.'



Mallik 2L38 drilling rig

While Canada hasn't committed the level of resources that others have to the investigation of hydrate reserves, Dallimore believes that the country has the potential to be a world leader. 'But it will take the active participation of government and industry in research and exploration to do it.'

upstream

Online asset management and government licences

ccording to George, there's been a lot of interest in online licensing from governments around the world. For example, he has been advising the Agencie Nacional do Petrolier (ANP), the national petroleum company of Brazil, which has offered two rounds on the Internet in order to simplify process management and communication. 'The actual options whether to put detailed data on the site may or may not be important. For detailed data, more bandwidth is required. However, some say: "Just because you can do it, doesn't mean you want it!"', comments George.

In Brazil, Round One was held in late 1998 and completed in mid-1999. Round Two was started in late 1999 and completed in mid-2000. Although all the bids are now known, contracts will be signed this month. **Indigopool.com** was not used as the platform for this particular licensing round. Instead, it was produced as a customised platform by Gaffney Cline for Round One, which was further refined for Round Two.

Elsewhere, Gabon, West Africa is using **Indigopool.com** for its current licensing round, which has been running a few months and involves both onshore and offshore blocks.

A number of other countries, including India and Namibia, have posted a statement from the Energy Minister, detailing general background information so oil companies can download 'terms and conditions', explains George. 'But these sites were pretty static and were not updated very often. They were more like noticeboard-type sites.'

He believes that Brazil was the first country to actively use the Internet for licensing purposes. The site was regularly updated with process, timetable, and additional information of a public nature, including Q&A sessions with companies – with answers posted up for general reference. There were also some confidential areas, protected by passwords.

Brian Davis examines the early initiatives in asset management online – in particular the impact as various governments begin to offer licences via the Internet. He talked with Bob George, Senior Advisor at Gaffney Cline, who has been closely involved with Indigopool.com - the Schlumberger-owned site, and who has also been advising various government-owned energy initiatives.

Columbia's Ecopetrol has also been looking at aspects of data delivery for a new licence round on the Internet.

Key issues

George suggests a key issue using the Internet is being timely, up to date, accurate and user friendly. 'Many countries are considering how to utilise the Internet, but there is still some hesitation between going down the process and communication side of physical delivery of the data. Frankly, we anticipate a lot more on the process and communication side.'

There are also issues regarding the volume of data involved:

- Bandwidth right now there is not sufficient bandwidth available at every desktop, although some 1:1 links are available using EDI, but that's an expensive option.
- But even if it is possible, it's not clear whether most countries feel it is appropriate or even desirable for reasons of communication with companies and the value of face-toface meetings.

'Some countries are still nervous about the control and distribution of data, considering the security concerns. I think there will be hesitation until it has been done enough times,' comments George.

Asset management

There are already a few Internet sites offering online asset management. Many more are coming – it's simply a matter of searching the Net.

Some current players include:

- Petroleumplace.com Pennwell's oil and gas site (the publishers of Oil & Gas Journal) at www.pennNET.com
- Indigopool.com
- UK LIFT at www.uk.lift.co.uk
- TheOilsite.com (see box piece)

Wellbid.com

There have not been many transactions to date on these sites. A lot of them are currently focused on the North American market, generally handling fairly small properties. But it's still early days. 'Everyone is interested in the global aspect of portfolio management, which is starting to take off,' says George. Here again there are two key issues. First, getting enough 'content', i.e. properties and packages, out there globally. Secondly, and very importantly, these must be quality properties and assets, not just peripheral.

George is convinced that growth will be fast. 'It is going to change the way companies look at portfolio management. Companies will look to much more actively manage their portfolio, and will trade those parts which are no longer strategic to them, as the companies are being very strongly driven to get their returns up.'

Generally, the Internet offers the ability to reduce cost and also to reduce transaction time. For example, asset packages normally take a few months to market. However, the Internet could speed up data access and evaluation, with broader and quicker communication. At the fast end of the business, this will translate months into weeks, but some aspects of property trading won't change as fast.

Most parts of the energy business

are amenable to improvement, and Gaffney Cline claims it has developed a generic model to look at how things are going to develop in four areas:

- e-trading,
- e-procurement,
- field management and operations, and
- portfolio and resource management.

As George explains: 'The first two areas are underway, although e-trading is taking off slower. In terms of field management and operations, compa-

TheOilsite.com

Oilsite.com is a new, independent dot.com which went live in early July offering a simple 'classified noticeboard' for dealing in equity in areas of of E&P activity across the world. According to one of the principals, Steve Islett, a former oilfield geologist, research has indicated that oil industry people felt it would be a good idea to have a central agency online, in order to see what properties are available.

Oilsite.com is developing a system where people selling a percentage of properties can easily post details on the Internet. It has designed a standardised template that a seller can call up to fill in information. It has been up since 11 June and a number of companies have already registered – some have posted up details of their properties. But the site will only open for business when a critical number of sellers are registered – that number has not been made available publicly.

There is zero commission for sellers who carry out a successful deal on acreage. Sellers will simply be charged \$250 a month for posting up details of each property. 'It's a no-brainer for them at this price,' says Islett.

According to CEO Mike Docherty, the main difference between Oilsite.com and ventures like **Indigopool.com** is the level of data offered. 'We will only put on this site pre-confidentiality information, not large data sets. We're nies are looking at various parts of the business process in order to determine how to use the Internet, such as process control of offshore wells.'

The model that George tends to hear most often in the oil industry is the 'Try, learn, try model'. He admits that, of course, there are dangers when you commit yourself, so some avoid taking risks. However, the feeling in the Internet world is: 'Get involved, learn things as you go along. See what works and what won't, and most important, keep ahead of the game.'

not trying to compete with Indigopool.com, where they can offer a full transaction facility. We are more like a classified advertising site on the web, which will allow companies to post a brief description. But we find that a lot of companies just want to post information on the web.'

He initially thought the portal would only appeal to smaller companies, but some of the larger, secondtier oil companies have expressed interest in entering details. The site went live at the beginning of July, following an e-procurement marketplace initiative that will run alongside. The e-procurement marketplace will simply be a tool for buyers and sellers, with about 6,000 equipment categories, and there will be a 1% commission charge to sellers.

Docherty says there has also been a lot of interest from national oil companies both for e-procurement and property sales. 'This is interesting because they are sitting on a lot of acreage.' But initially Oilsite.com won't offer government licensing rounds, although they plan to eventually. In the interim some governments may use the site for procurement purposes.

Oilsite.com is totally independent and is keen to remain seen as an unbiased exchange, 'as some suppliers are already expressing concern about the oil industry exchanges,' comments Docherty. The site has cost about £2mn to set up.



gas

<u>Canada</u>

Alberta snuffs a thousand flares

Early this fall, the Alberta Energy & Utilities Board (AEUB) is to release a study – entitled Upstream Flaring Management Annual Report – that will quantify the effects of recent provincial regulations targeting the industry practice of flaring. Gordon Cope reports.



Gilbertson, one of the authors of the report and a spokesman for the AEUB, highlighted some of the findings for *Petroleum Review*. 'Industry has responded well to the initiatives. At least 1,000 flares have disappeared in Alberta, and there have been significant reductions in volumes flared.'

'The oil and gas industry really recognised the public concern [about gas flaring],' says Frank George, spokesman for the Canadian Association of Petroleum Producers (CAPP), the industry's main lobby group. 'I haven't seen the final data, but I think we'll see a reduction of 30% – we're well ahead of the target for 2001.'

The reduction in gas flaring is much appreciated by rural residents and ranchers, who were the impetus for the change. 'I recall driving at night to my farm,' says David Brown, a rancher who lives near the massive Caroline gas field in central Alberta. 'There were so many flares you could see the road without your headlights. Now, there are very few flares.'

Burning tradition

Since its inception before the First World War, the upstream oil and gas industry in Alberta had traditionally burned off solution gas, an unwanted by-product of oil production. In addition, some unwanted gases accumulated at well tests, gas plants and gathering systems, and were similarly flared.

In theory, the flaring of gas is highly efficient and safe. A flare, essentially a long steel pipe with a flame source attached to the top, is designed to ignite the solution gas so that 98% of the methane, sour gas, toluene, benzene and xylene is converted into sulfur dioxide, carbon dioxide and water.

By the mid-1990s, approximately 5,500 flares around the province were burning off almost 1.7bn cm of solution gas every year. In addition, another

0.2bn cm was being flared from well tests, gas plants and gathering systems.

Point of contention

As oilpatch activity increased and more people moved into rural Alberta, gas flaring became a point of contention between producers and nearby residents and ranchers. 'As far as I was concerned, that was my gas they were wasting, and we were losing the royalties,' says Brown, who is a founding member of the Sundre Petroleum Operators Group, a partnership of community, industry and AEUB members.

Other rural residents worried that the flares were affecting the health of themselves and their livestock. Open pipe flares burn with maximum efficiency only when weather conditions are ideal and the methane is pure, they claimed. When those conditions don't exist, toxic, unburned compounds can escape.

Better understanding needed

In order to a better understanding of the issue, the Alberta Research Council instigated a flare study in 1996. Under Senior Research Officer Mel Strosher, the team determined that liquid fuels in the flare-bound gas stream, such as benzene, toluene and xylene, were the largest contributing factor in reducing combustion efficiencies. In one case, liquids in the gas stream reduced combustion efficiencies to 62%. As a result, known cancer-causing compounds were released into the atmosphere.

'Government, industry and the public were all in agreement that things couldn't go on the way they were,' says Gilbertson. 'Something had to be done.'

Under the AEUB, industry, government and members of the public formed an action group. They quantified the practice of flaring, then devised an action plan and timetable.

In mid-1999, the AEUB unveiled Guide 60, an upstream flaring regulation that came into effect January 1, 2000.

A prime directive of Guide 60 was to

establish goals for reduction of overall flaring. It took as its baseline an annual burn of 1.7bn cm, which was roughly the amount of solution gas flared from crude oil and bitumen batteries in 1996. We had two firm targets,' says Gilbertson. 'We wanted a 15% reduction by the end of 2000, and 25% by the end of 2001. Solution gas from flaring should amount to no more than 1.275bn cm for the year 2002.'

Exploration flaring, where a gas well is production-tested prior to being hooked to a pipeline system, would also be reduced. 'In previous years, when you had a big exploration gas well and no pipeline, you had to production test through large, lengthy flaring runs,' explains Gilbertson. 'Now they have to do a shorter run, or in-line testing, where they run a temporary pipeline overland to an existing gas line.'

Regulatory response

The service industry responded well to the new regulations. 'When we saw Guide 60, our message was there's nothing in here that can't be done,' says Jim Manis, Vice President of Tornado Technologies, an industry leader in flaring equipment. 'Our company can supply this, and in some instances, elevate the Guide even higher.'

According to Manis, Tornado spends more than \$1mn annually on research and development of efficient combustion equipment. By carefully controlling the mix of air and solution gas, for instance, consistently high values of combustion – in the neighbourhood of 98% – can be achieved using relatively inexpensive flaring equipment. 'A good engineered flare costs around \$25,000-\$35,000,' he notes.

Special incinerators have also been developed as an alternative. The large, portable combustion chambers mix the gas and air at high temperatures in order to destroy such trace carcinogens as toluene and benzene.

Although costing twice as much as flares, incinerators can achieve much higher efficiencies. 'There was a glycol dehydrator (a device for removing water from raw gas) in New Zealand that was releasing a very high concentration of benzene, toluene and xylenes – around 23%,' says Jerry Smolarski, a Senior Scientist at Tornado Technologies. 'We designed an incinerator and did a stack emissions test. The limit of the test equipment was 9 ppb, and it couldn't detect anything. It was virtually 100% clean.'

Another alternative to flaring is the use of micro-turbines to produce heat and electricity by burning the raw gas onsite. A government-sponsored report estimated that half the solution gas that is currently flared could be used to generate electricity. The gas could produce over 200 MW of generating capacity, or just under 5% of Alberta's total.

Alberta's oil and gas industry immediately adopted Guide 60, and moved toward compliance on a number of different fronts. 'First of all, any project to capture gas that earns the cost of capital is implemented,' says CAPP's George.

Where conservation isn't immediately practical, many companies have opted for alternatives to flaring. Anderson Exploration, for instance, installed an incinerator at its North Cecil gas plant in northern Alberta. PanCanadian and Northrock Resources installed microturbines in various locales.

Eventually, the AEUB would like to see all routine solution gas flaring and venting eliminated. 'We're on path to elimination,' comments CAPP's George. 'We could see reductions of 70% by 2007, but after that we're going to need new technologies to lower it further.'

Impetus for change

In the meantime, regulators from other countries are eager to examine the AEUB's policies. 'We constantly get inquiries from other jurisdictions,' says Gilbertson. 'We have had delegations from Russia, China, Venezuela, Chile and Argentina.'

In the end, however, Brown believes it is the residents of affected communities who will provide the impetus for change. 'You have to talk to the industry and get involved,' he recommends. 'Don't fight – just sit down and negotiate as a community. It's an awful lot of work and effort, but you'll all gain.'



Crude oil marine measurement annual review

This article by *Paul S Harrison* – Consultant to the PM-L-4(A) Marine Oil Transportation Database Panel – presents findings from analysis of the 1999 data, updating the 1998 analysis which was reported in *Petroleum Review* in October 1999.

The PM-L-4(A) Marine Oil Transportation Database Panel collects and analyses worldwide crude oil shipping data with the general aim of improving loss control through a better understanding of loss patterns and trends. The losses noted are generally apparent rather than physical losses and result from the combination of fixed and random errors in the measurement systems used at load and discharge.

The Panel was formed in 1986 and membership has grown steadily. The following 20 companies submitted data for 1999:

AGIP Petroli BP Amoco Oil Caltex Trading Pte Ltd Chevron International Conoco Elf Antar France Elf International (SOCAP) Equiva Trading Company Esso Petroleum Company Limited ExxonMobil Company Marathon Ashland Petroleum LLC Petrogal SA PMI Pemex Repsol YPF Saras Spa Scanraff (PREEM) Shell Statoil Sunoco Inc Total

Panel members submit their company data for analysis and an annual report is issued individually to all members. This report includes a confidential analysis of the individual company data together with a general global analysis of the entire annual data set.

Membership is open to all oil companies with data to contribute.

Database growth

The size of the database has increased over the years, due partly to the growth in membership but also as a result of existing members gathering data from additional affiliates. This growth continues as shown in **Figure 1** with a total volume of 4.11bn barrels for voyages with full load and discharge data reported in 1999.

Comparative figures for 1999 indicate that full measurement data on 36% of world seaborne crude is included in the 1999 database with bill of lading (BOL) data on 43% of the world total. Data for over 7,400 individual voyages were submitted.

Global mean loss

With the database including over a third of the global shipped volume it seems reasonable to assume that the overall mean loss by voyage from the database provides a good estimate of the global situation. The mean net standard volume loss (NSV) figure will be weighted by the number of voyages in the database for each crude/load port which is closely related to volume. The internal weighting will change year on year as crudes and volumes change, but the database is now sufficiently large not to be unduly influenced by input from new members or by other minor structural changes.

Mean NSV loss from the database from 1989 to 1999 is plotted in **Figure 1**. The overall improvement since 1989 is readily apparent, although global loss has been fairly stable since 1995. Mean NSV loss for 1999 was -0.191% (by convention losses are given as negative). This is identical to the 1998 figure.

Loss comparison

Table 1 gives mean NSV loss and standard deviation for shipments of the most popular crudes in the database (20 or more voyages with full data). The mean of the reported API gravity is also given, together with the overall percentage loss based on total barrels shipped.

For comparison, figures for NSV loss calculated by voyage are given for 1999 and 1998. Where a grade is not reported for 1999 as the number of data sets has fallen below 20 the API gravity is given as the 1998 mean value.

Note that the data in **Table 1** is not 'table corrected' but based on original BOL figures. Where possible, for load ports using 'old' (1952) Table 6 or Table 54, corrected BOL figures are calculated using 'new' tables for comparison with outturns at discharge ports which also use the 'new' (1980) tables. The effect of using table-corrected BOL data for



Crude type	API gravity	Overall volumes (NSV)			Calculation by voyage			
		Total	Barrels	Barrels	NSV lo	ss %	NSV	loss %
		Darreis	1055	1055 70	Wear Sur		Mean 3	
Abu Safah	28.6	11,443,643	-11,874	-0.10	-0.11 0.1	8 23	-	
Alaskan North Slope	30.1	142 968 642	-80,423	-0.06	-0.06 0.1	4 185	-0.07	0.16 219
Alba	19.1	13,189,398	-44,614	-0.34	-0.31 0.4	9 23	-0.10	0.57 24
Amna	37.8	28,425,620	-65,532	-0.23	-0.23 0.2	2 50	-0.23	0.21 49
Arab Ex Lt	38.5	130,090,699	-263,263	-0.20	-0.21 0.2	172	-0.14	0.46 78
Arab Heavy	28.0	49,107,377	-100,929	-0.21	-0.16 0.5	122	-0.31	0.61 122
Arab Light	33.0	210,647,079	-465,710	-0.22	-0.19 0.2	1 126	-0.17	0.43 243
Arab Wedium	30.4	13 968 935	-221,245	-0.07	-0.01 0.1	4 21	-0.25	
Bach Ho	40.5	17.624.273	-72,082	-0.41	-0.41 0.3	9 49	-	
Basrah Light	32.4	66,535,800	-82,890	-0.12	-0.13 0.4	43 50	-0.25	0.31 42
Belayim	27.8	22,159,472	-14,356	-0.06	-0.08 0.3	30 45	-0.04	0.26 42
Bonny Light	34.2	22,426,132	-31,094	-0.14	-0.13 0.3	34 24	-0.09	0.39 51
Bouri	26.2	18,299,414	-44,845	-0.25	-0.28 0.5	32	-0.34	0.40 31
Cabinda	38.4	17 020 655	-27,441	-0.05	-0.06 0.1	33 55	-0.10	0.24 50
Cano Limon	29.6	14 372 783	-14,777	-0.10	-0.11 0.2	23 29	-	
Caripito Blend	22.1	-		-	-		-0.03	0.36 39
Cusiana	40.4	34,744,965	-81,945	-0.24	-0.23 0.1	18 52	-0.27	0.18 38
Danish	35.3	20,711,937	-29,675	-0.14	-0.14 0.1	3 34	-0.14	0.13 26
Draugen	40.7	57,159,711	-196,007	-0.34	-0.34 0.1	69	-0.34	0.15 56
Dubai	30.8	12,235,055	5,028	0.04	-0.05 0.5	20 21	-	
Duri Ekofisk	20.9	9,205,910	-10,472	-0.18	-0.09 0.1	16 125	-0.03	0.13 167
Exolisk Es Sider	36.2	19 546 031	-84.041	-0.43	-0.45 0.3	34 33	-0.35	0.47 34
Escravos	33.9	44,481,526	-48,777	-0.11	-0.11 0.2	20 41	-0.12	0.20 53
Flotta	36.9	28,852,355	-75,820	-0.26	-0.26 0.2	25 46	-0.28	0.20 75
Foinaven	26.1	37,532,726	73,411	0.20	0.20 0.8	30 77	0.32	0.51 66
Forcados	29.9	19,878,533	4,567	0.02	0.00 0.2	24 22	-0.09	0.35 35
Forozan	30.9	62,306,447	-104,461	-0.17	-0.15 0.4	17 175	-0.17	0.28 02
Forties Blend	41.2	117,223,400	-147,600	-0.15	-0.12 0.		-0.06	0.34 49
Gullfaks A	33.6	87.081.333	-357,111	-0.41	-0.41 0.2	21 104	-	1.5
Gullfaks C	35.5	45,260,407	-147,959	-0.33	-0.33 0.1	14 54		
Harding	20.2	17,533,940	-83,472	-0.48	-0.47 0.6	54 33	-0.54	0.53 34
Heidrun	27.8	29,037,198	19,567	0.07	0.08 0.2	26 46	0.02	0.23 37
Hibernia	35.0	20,485,296	-7,624	-0.04	-0.05 0.3	25 110	-0.18	0.30 107
Iranian Heavy	30.2	94,405,290	-795,964	-0.21	-0.22 0.	56 73	-0.21	0.27 68
Isthmus	33.3	17,481,566	-34,531	-0.20	-0.13 0.5	51 40	-0.19	0.57 25
Kirkuk	34.2	130,913,018	-252,081	-0.19	-0.19 0.3	34 138	-0.23	0.25 142
Kuwait	30.4	49,338,467	-80,175	-0.16	-0.15 0.1	17 46	-	
Lower Zakum	39.8	26,799,095	-84,935	-0.32	-0.33 0.1	17 64	-0.34	0.16 50
Masila	31.1	35,510,671	-53,831	-0.15	-0.17 0.	12 34	0.22	0 23 197
Masa 30	21.0	37 271 765	-424,005	0.04	0.06 0.1	28 69	0.02	0.26 35
Murban	39.2	67,133,869	-167.772	-0.25	-0.26 0.3	22 107	-0.32	0.29 60
Nemba	38.5	28,607,969	-111,239	-0.39	-0.38 0.3	30 33	-	
Njord	41.0	10,523,666	-4,039	-0.04	-0.04 0.1	18 21	-	
Norne	32.5	46,967,067	-43,008	-0.09	-0.09 0.4	42 66	-0.17	0.26 21
Olmeca	38.7	94,339,365	-176,929	-0.19	-0.19 0	35 180	-0.19	0.25 148
Oman	32.4	82,773,139	-206,838	-0.25	-0.27 0.	23 102	0.20	0.59 26
Oseberg	37.0	39 468 120	-63,706	-0.16	-0.16 0.	16 52	-0.15	0.16 77
Oatar Land	41.0	25,230,774	-98,495	-0.39	-0.39 0.	14 53	-0.37	0.09 39
Qatar Marine	34.0	29,524,145	-74,350	-0.25	-0.26 0.	16 45	-0.31	0.14 40
Qua Iboe	36.9	77,007,097	-213,122	-0.28	-0.25 0.4	48 77	-0.15	0.39 43
Rabi Light	34.7		-		-		-0.26	0.22 24
Russian Export Blend	31.9	165,326,020	-341,054	-0.21	-0.21 0.	24 256	-0.15	0.27 192
Sanaran Biend	40.0	13 824 122	-10 302	-0.07	-0.08 0	17 29	-0.15	0.34 27
Sarir	37.7	16.077.251	-29,446	-0.18	-0.18 0.1	22 27	-0.34	0.24 35
Siberian Light	35.0	14,502,202	-27,224	-0.19	-0.18 0.	30 29	-0.23	0.28 28
Sirtica	40.1	16,105,492	-34,186	-0.21	-0.22 0.	23 28	-0.16	0.16 26
Souedie	24.4	16,167,986	-36,094	-0.22	-0.20 0.	30 36	-0.21	0.50 31
Statfjord	39.1	148,827,896	-385,328	-0.26	-0.26 0.	22 185	-0.28	0.26 207
Syrian Light	36.1	40,490,170	-110,333	-0.25	-0.25 0.	33 30	-0.32	0.51 51
Tengiz	45.9	27,554 727	-120 178	-0.44	-0.44 0	35 66	-0.57	0.38 47
Thamamma Condensat	te 58.6	10,778,051	-26,848	-0.25	-0.24 0.	19 22	-	
Troll	27.9	19,639,851	-24,860	-0.13	-0.14 0.	18 31	-0.01	0.20 45
Umm Shaif	37.1	11,739,203	-29,727	-0.25	-0.26 0.	16 31	-0.38	0.10 40
Upper Zakum	34.2	21,077,325	-51,033	-0.24	-0.27 0.	10 33	-0.04	0.15 28
wytch Farm	41.6	-	-	-	-		-0.04	0.15 20

Table 1: Analysis by crude oil type 1999

shipping



Database

Crude type	Mean NSV Loss % Original Corrected		Table difference %	
A960	-0.22	-0.10	0.12	
Arab Ex Lt	-0.26	-0.13	0.13	
Arab Light	-0.23	-0.06	0.16	
Arab Medium	-0.24	-0.13	0.10	
Dubai	-0.16	-0.07	0.10	
Lower Zakum	-0.17	-0.05	0.12	
Marib Light	-0.21	-0.15	0.06	
Minas	-0.07	0.06	0.13	
Murban	-0.21	-0.07	0.14	
Oman	-0.17	-0.03	0.13	
Qatar Land	-0.36	-0.27	0.09	
Qatar Marine	-0.24	-0.17	0.07	
Saharan Blend	-0.22	-0.17	0.05	
Senipah	0.05	0.32	0.27	
Souedie	-0.18	-0.16	0.02	
Svrian Light	-0.41	-0.36	0.06	
Tapis	-0.36	-0.24	0.13	
Umm Sharif	-0.05	0.01	0.06	
Zarzaitine	-0.36	-0.33	0.03	
	84-	an difference	04 0 104	

Table 2: Effect of table corrections on net standard volume loss figures for individual crude oils

	1999		1998	
and the second second	Mean	St dev.	Mean	St dev.
NSV loss %	-0.19	0.35	-0.19	0.36
TCV loss %	-0.13	0.33	-0.13	0.35
Load difference %	0.11	0.40	0.14	0.40
Ship loss %	0.04	0.24	0.02	0.20
Discharge difference %	-0.29	0.44	-0.30	0.44
Water loss %	-0.06	0.20	-0.07	0.20
ROB difference %	0.03	0.15	0.04	0.16

specific crudes is shown in Table 2.

It should be noted that as the information in **Table 2** is derived from a smaller set of voyages than those used for **Table 1** (i.e. those with both corrected and uncorrected BOL figures) the actual mean losses will differ. The above figures are based on a minimum of five voyages per grade.

Detailed loss analysis

In addition to NSV loss figures the database contains details of all measurements made through each voyage. This enables more detailed analysis to determine where losses are occurring and sets realistic performance limits for each stage in the measurement process.

Overall results for each of the main measurement differences are shown in **Table 3**, comparing figures for 1999 with those for 1998. The only significant difference between the two sets of results is a small reduction in the gain seen at load (load difference) which is balanced by a similar reduction in the loss seen at discharge (discharge difference). Key comparisons used in the analysis are as follows:

- NSV and total calculated volume (TCV) losses are simple comparisons between bill of lading and outturn figures. NSV is the volume of crude corrected to 60oF with sediment and water quantities (free and dissolved) deducted. TCV is the NSV plus sediment and free and dissolved water.
- Load difference is the TCV difference between the ship after loading and the shore delivered volume. Discharge difference is the TCV difference between the ship before discharge onboard quantity (OBQ) and the shore received volume. Load and discharge differences are not corrected for vessel experience factor (VEF). However, load loss and discharge loss figures are calculated making allowance for OBQ and remaining on board (ROB) (the difference between the TCV measured on the ship prior to loading and that remaining after discharge) and taking into account load VEF.
- Ship loss or 'transit difference' is the difference between ship TCV measurements at the load port before sailing and at the discharge port on arrival.
- Water loss is the difference between BOL and outturn water and sediment, adjusted for ROB/OBQ water difference where figures are available.

One clear and staticistically significant change noted in the 1998 analysis



was a reduction in the load difference. This was balanced by a similar increase in discharge difference. It can be seen from **Table 3** that load difference has again fallen, although a smaller rise in discharge difference is apparent from 1998 to 1999.

Comparison with the load and discharge loss figures, which are adjusted for VEF and OBQ and ROB, produces **Figure 2**. This shows that the gap between the uncorrected 'difference' figures and the corrected 'loss' figures is reducing. This can only be the result of a general reduction in VEFs and/or a reduction in OBQ and ROB volumes.

Figure 3 shows that there has indeed been a fall in load VEF values over the past five years. This fall is apparent from the average by voyage values and remains when the average by vessel is considered. The fall is significant and may well be due in part to to the gradual introduction of new vessels with double hulls and more easily calibrated tanks.

OBQ and ROB (expressed as percentages of BOL and outturn TCVs respectively) have also both fallen, as shown in **Figure 4**.

The fall in ROB is not so marked as the



fall in OBQ, but it must be remembered that the ROB figures are as measured immediately after discharge – when much of the actual ROB is present as 'clingage' on the tank sides and is not measurable. The reduced OBQ and the reduced OBQ–ROB difference indicates that this clingage volume is reducing. Again, this could be due to increasing use of double hull vessels or perhaps a combination of this and more effective crude oil washing.

Conclusions

The 1999 data indicates that the loss reductions seen from 1989 through to 1995 have levelled off with average NSV loss for 1999 standing at -0.191% (the same value as for 1998). However the global loss pattern seems to be changing in relation to ship/shore comparisons. An article looking in more detail at the influence of vessel type and age on measurement differences will be published in a forthcoming issue of *Petroleum Review*.

Panel membership

With the continued recovery in oil prices these 'measurement losses' now represent almost \$700mn worldwide. Oil companies working through their loss control groups are urged to continue their support of activities aimed at understanding and reducing these losses.

The database expanded in terms of volume and voyage numbers from 1998 and it is estimated that 36% of world seaborne crude is included for 1999. All additional data adds to the value of the database. The information derived from the database and the panel has a target of 50% of seaborne crude trade, which it hopes to achieve by 2005. A number of new members and prospective new members attended meetings in Oaxaca, Mexico in November 1999 and in Sardinia in May this year.

The panel meets twice a year and meetings are held in conjunction with those of its 'sister' panel, PM-L-4B – The Oil Transportation Measurement Panel. The next meetings will be held in Stratford on Avon, UK, on 24–26 October 2000 and will be hosted by Conoco. Prospective new members are welcome and are encouraged to contact John Phipps at the Institute of Petroleum for further details – Tel: +44 (0)20 7467 7130, e: **jp@petroleum.co.uk**

1. BP Amoco Statistical Review of World Energy 1999.

Disclaimer: The IP as a body is neither responsible for the statements or opinions presented in this article, nor does it necessarily endorse the technical views expressed. **Publications and Data Services**

Spindletop

James A Clark and Michel T Halbouty (Gulf Publishing, Book Division, PO Box 2608, Houston, Texas 77252-2608, USA). ISBN 0 88415 813 6. 306 pages. Price: \$26.95.

Republished as a special 'Centennial Anniversary Edition.' this book tells of the true story of the events leading up to and the boom days that followed the first great American gusher which, on 10 January 1901, spouted oil a hundred feet over the top of the derrick out on the hummock that the world soon came to know as Spindletop. Overnight, the town of Beaumont, Texas, became bedlam. The population doubled and doubled again. In hotels and boarding houses men slept in relays, 20 to a room. Speculators made fortunes, and lost them in the gambling halls that kept open 24-hours a day, At one point, oil was so plentiful that it sold for 3 cents a barrel, and water so scarce that a barrel cost \$6. Written by two men who grew up in Beaumont and worked in the field during the second boom of 1925, the story is brought vividly alive by its colourful portraits of the men who played a part in this great adventure, most of whom the authors knew personally.

Stratigraphic Systems – Origin and Application

Glen S Visher (Academic Press, 525 B Street, Suite 1900, San Diego, California 92101-4495, USA). ISBN 0 12 722360 6. 700 pages. Price:£49.95 (\$79).

This publication provides a comprehensive and up-to-date treatment of stratigraphic analysis for those working in stratigraphy, sedimentology, petroleum geology, geophysical interpretation and reservoir engineering. Stressing an analytical, rather than a descriptive, approach to predicting temporal and areal stratigraphic patterns, the book conveniently organises stratigraphic systems into basinal frameworks. It places observations in a historical and paleogeographic context and includes more than 700 figures and tables. A CD-ROM is also supplied with the book, featuring expert systems software for identifying or verifying stratigraphic intervals.

Petroleum Waxes and Related Products

(Available, free of charge, from CONCAWE, Madouplein 1, 1210 Brussels, Belgium). 32 pages.

This report (product dossier no. 99/110) summarises the physical and chemical properties, as well as toxicological, health, safety and environmental information available on waxes and related products. These include the slack waxes, petroleum waxes and petrolatum.

Blowout

Robert Orrell (Seafarer Books, 102 Redwald Road, Rendlesham, Woodbridge, Suffolk IP12 2TE, UK). ISBN 085036 4 892. 194 pages. Life on an oil rig is tough, brutal and dangerous - as Bob Orrell discovered when he worked as a radio operator on the Hewett 'A', drilling for gas in what is said to be one of the world's wildest and hostile seas. Here he recounts the dramas of life onboard - the characters, the humour, the tragedies, the fights, the camaraderie, the appalling accidents and the atrocious weather. At the height of a fierce winter gale, the rig sufffered a disastrous blowout and, although every ship in the vicinity responded to the author's 'Mayday' call, huge seas prevented them from reaching the rig. Orrell gives a harrowing account of events leading up to the blowout, and how rescue boats and helicopters battled against gale-force winds, icy conditions and raging seas to evacuate men from the platform. He and the toolpusher were accidently left stranded on the doomed rig, and eventually had to leap for their lives into a hovering rescue helicopter. Red Adair, the legendary Texan oil rig firefighter, was flown from the States to attempt to cap the well - Orrell went back with him to the Hewett 'A' to man the communications.



E-mail from the library

Please note that you are now able to send e-mails from the IP Library if you have your own laptop and modern with you.

IP Library Anniversary – An Evening Wine Reception

Please come and join us in a glass or two of wine to celebrate the Institute's new library facilities and services at 61 New Cavendish Street, London, on 17 October 2000. The reception is by invitation only – please contact Catherine Cosgrove at e: ccosgrove@petroleum.co.uk if you would like a ticket.

Library Open Day - 18 October 2000

The Institute of Petroleum is opening its doors on 18 October 2000 to highlight its new library facilities and services. Everyone, member and non-member alike, is invited to browse our well-stocked bookshelves and test out our latest computing facilities and services. An overview presentation of the IP Library and Information Services will be given at 11am, and again at 3pm. Please see our website at **www.petroleum.co.uk** for more information.

Information for Energy Group (IFEG)

Date for your diary: Thursday 7 September 2000 Afternoon seminar entitled 'Your Future in Your Hands – Selling Yourself and Your Services.' See page 45 for more details or visit our website at www.petroleum.co.uk/ifeg.htm

Library & Information Service Hours

Open 9.30am to 5pm Monday to Friday (except Bank Holidays). Non-members are welcome on payment of an entrance fee of £19 for a half-day or £27 for a full day.

Student non-members may use the library for ± 1.50 per day if they bring a letter of introduction from their tutor, together with their student ID card.

Contact Details

- Information Queries to: Chris Baker, Senior Information Officer +44 (0)20 7467 7114
 - Sally Ball, Information Officer, +44 (0)20 7467 7115
- Library holdings and loans queries to: *Liliana El-Minyawi*, LIS Assistant, +44 (0)20 7467 7113
- Careers and educational literature queries to: Information Assistant, +44 (0)20 7467 7116
- Website queries to: *Perry Hackshaw*, Webmaster, +44 (0)20 7467 7112
- LIS management queries to: Catherine Cosgrove, Head of LIS, +44 (0)20 7467 7111
- IFEG Queries to:
 - Sally Ball, IFEG Secretary, +44 (0)20 7467 7115

Fax any of the above on +44 (0)20 7255 1472 or e-mail: lis@petroleum.co.uk Visit our website at www.petroleum.co.uk

Training Courses 2000

Planning and Economics of Refinery Operations (PERO)

IP THE INSTITUTE OF PETROLEUM

organised in association with ENSPM Formation Industrie

London: 25–28 September 2000

This intensive four-day training course will cover: Technical Resumé Refinery Simulation Present Situation of the Refining Industry Refinery Margins and Costs Optimisation of Refinery Operations Scheduling of Refinery Operations How to Improve Refinery Profitability Future of the Refining Industry

Who should attend?

- Technical, operating and engineering personnel working in the refining industry
- Trading and commercial specialists
- Independent consultants
- Process licensors
- Catalyst manufacturers and refining sub-contractors

Trading Oil on the International Markets (ITO)

organised in association with Invincible Energy

Cambridge: 23-27 October 2000

Delegates will become part of Invincible's fictional trading team, taking decisions about the company's activities to maximise profits through an understanding of the economics of trading and the management of inherent price risks.

Delegates will trade the live crude oil and refined product markets worldwide under the guidance of an expert team of lecturers, reacting to events as they happen and using real-time information from Reuters and Telerate screens and daily price information from Platt's and Petroleum Argus.

Exercises are performed in syndicates, with comprehensive debriefs assessing the consequences of the decisions taken. The course expects a high degree of participation from delegates.

Who should attend?

Anyone whose work is affected by changes in the international oil price, including those in: Supply, trading, risk management, refining, finance, transportation, E&P in the oil industry Oil trading and distribution companies Energy-related government departments Purchasing, planning and finance in major energy consumers Energy publications Banks, accountants, auditors and others associated with oil companies and oil financing

Economics of the Oil Supply Chain (ESC)



organised in association with Invincible Energy

Cambridge: 16-20 October 2000

Delegates will examine the various activities of the fictional Invincible Energy Company to explore the economic forces which drive the oil supply chain. They will concentrate on the main areas of risk and opportunity from the crude oil supply terminal, through transportation, refining and trading to the refined product distribution terminal.

During their time in Invincible's refinery, delegates will learn about the quality aspects of product supply. They will study refinery process economics and the effects of upgrading. Blending to meet quality requirements at optimal cost will be examined. Delegates will construct and negotiate a processing deal. They will then follow the crude oil and the refined products from the refinery and look at the economics of various alternatives. International markets and trading will be studied, together with the various methods of price risk management.

Who should attend?

This five-day course is the essential foundation for people entering the oil industry or for those with single function experience. It is ideal for those: New to the downstream oil industry With single function experience in supply, transportation, refining or trading In the E&P, finance, downstream marketing or IT departments of oil companies Working in energy-related government departments Writing about the industry Bankers, accountants, auditors and others associated with oil companies and oil financing

Environmental Risk Management (ENV)

CORDAH

organised in association with Cordah Ltd

London: 30 October – 1 November 2000

This challenging and interactive three-day course provides delegates with essential practical skills to manage their environmental risks and liabilities. Using presentations and discussions, a team of experienced lecturers will guide delegates through strategic, managerial and technical issues in environmental management. Simulation exercises from actual oil and gas projects provide hands-on experience of environmental risk assessment, strategy development, prioritisation and management.

Who should attend?

Anyone whose work includes environmental responsibility or who needs to understand environmental issues, including: Policy makers/senior management Technical managers/specialist personnel Civil servants/regulators Environmental/project engineers Engineering/facilities management contractors HSE managers/specialists Reputation managers/specialists

For more information please contact: Nick Wilkinson, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, UK. Tel: +44 (0)20 7467 7151 Fax: +44 (0)20 7255 1472

INVINCIBLE

e: nwilkinson@petroleum.co.uk

NEWTechnology

Safeforce unveils hat-trick of new products

Safeforce, the safety and technical services division of plant hire company Vibroplant, has unveiled a number of new product ranges to complement its existing portfolio of detection and protection equipment.

The first is a new CCTV camera unit capable of providing detailed visual surveillance of pipelines and culverts. The Telespec cameras can cover up to 250 metres at a time, transmitting live images in colour to an above-ground visual display unit. Travelling along the pipe using a crawler mechanism, the units transmit images through 360° which means that joints and linings can be fully surveyed to ensure their strength and integrity.

The Telespec system comes in three main sizes, allowing for inspection of culverts and pipes as small as 150 mm in diameter and up to 1 metre in size.

Safeforce has also added intrinsically safe radios to its expanded range of communication systems, following an alliance with radio specialist Motek. The GP900 Motorola units are supplied for use in power plants and petrochemical facilities where normal cellular phones and radios are prohibited due to the risk of creating sparks in a potentially explosive environment. The intrinsically safe radio units have a range of up to three miles, depending on the surrounding environment.

In addition, the company also offers Status Scientific Controls' intrinsically safe hard-wired communication system, developed for use in underground situations – such as in mine shafts, ship hulls and submerged tanks and vessels – where normal radio-based equipment does not work. The Speachline system allows for communication between a maximum of seven people. Because it is a duplex system, more than one user can speak at a time, just like a standard terrestrial phone.

The BASEEFA-approved units are powered by three triple A batteries, allowing up to 100 hours of talk time before needing replacement.



CCTV camera unit

The system has been designed to allow pre-configured status mentor 'attendent' and 'entrant' gas detectors to be connected. Known as 'Lifeline', this system allows a 'top man' to communicate with colleagues in a confined space via the Speechline system while at the same time remotely monitoring their gas detector readings.

Tel: +44 (0)1423 533400 Fax: +44 (0)1423 520739

Multi-manufacturer valve positioner

Neles Instrumentation has extended its range of ND800 digitial positioner technology so that it can be used in conjunction with other manufacturers' rotary or linear valves. The ND800 digital positioner provides extensive monitoring for diagnostics and is also said to be capable of improving a control valve's speed of response and positioning accuracy which, in turn, offers improvements in process stability.

The positioner automatically collects diagnostic data from the valve (ie actuator load factor trend) online as the valve is working in real process conditions. Captured trend data helps to identify valves requiring maintenance. It can also reduce preventative maintenance costs, claims the company, by identifying valves that are performing well and do not require attention.

Neles FieldBrowser[™] software can monitor networks of ND800 equipped valves, passing trend information to a database and sending warnings via intranet, Internet and even mobile phone when pre-set alarm conditions are exceeded.

Upgrading other manufacturer's valves with ND800 digital positioners requires the purchase of ND800 positioner and mounting parts. Neles has a 'library' of mounting parts suitable for use with all major valve brands. Versions



of the positioner are also available for use in HART and Fieldbus networks. Adapting an ND800 to a different protocol in the field simply requires the replacement of a circuit board, states the company.

Tel: +358 20 483 150 Fax: +358 20 483 5878

DrGeo and DrDTM

ECL has been appointed exclusive worldwide rights to market and distribute two versatile PC-based software systems for use within the oil and gas exploration sector. The first, DrGeo, is produced by Activesoft. DrDTM is produced by Spatial Sofware. Both companies are based in Perth, Western Australia.

DrGeo is a multimedia software application for the acquisition and interpretation of single channel analogue seismic data, commonly used for shallow seismic data studies such as offshore drilling rig site investigation and bathymetric surveys. DrDTM is a 32-bit Windows-based mapping suite. It includes many of the advanced modelling and visualisation features typically only found on highend Unix workstations based DTM systems, including 'fly-through' perspective viewing of generated terrain models.

When combined, DrGeo and DrDTM offer a complete shallow seismic data acquisition, interpretation and 3D visualisation solution, states ECL, capable of running an entire project on a single notebook computer. All that is needed to complete the equipment requirements is an energy source, such as a boomer or sparker, and a source of navigation data, such as ECL's own PALS system.

Tel: +8 9322 4333 Fax: +8 9322 7254



NEWischnology

Sabre severs casing strings and costs



Norwich-based UWG has developed an abrasive cutting system, claimed to be capable of severing multiple casing strings, to complement its subsea and platform well abandonment equipment portfolio. The Sabre System is said to effectively sever all casings in a typical wellbore (9 ^{5/8}-inch, 13 ^{3/8}-inch, 20-inch and 30-inch strings) simultaneously, regardless of the casing loading, eccentricity and type of fluid in the annuli.

The system is also said to provide 'significant' cost savings as it can be operated without the use of a drilling rig. It is ideally suited for severance operations on smaller platforms and on subsea wells in situations where explosives are not practical, as it is capable of being deployed from a diving support vessel (DSV). The system is claimed to be so sensitive that it can facilitate the cutting of internal casings only, without damaging the external casings or wellheads.

Sabre can be complemented by UWG's drilling and pinning machines, as well as its rapid band saw for conductor and casing string recovery, enabling a total cold cutting approach for conductor severance and recovery.

UWG acts as the lead contractor for the PACT platform well abandonment consortium.

Tel: +44 (0)1603 767438 Fax: +44 (0)1603 767441

New-generation seismic technology

Schlumberger recently unveiled its latest component in the company's new Q(a) seismic acquisition and processing system. The Q-Borehole technology is claimed to optimise all aspects of borehole seismic – from job plannning, acquisition and processing, to delivery and interpretation. It is also said to offer greatly improved imaging of complex subsurface structure in less than half the time taken to deliver conventional borehole seismic results.

The technology uses a versatile, fieldconfigurable downhole tool with up to 20 multi-component sensor shuttles that provide real-time data at varying sample rates. The downhole tool is claimed to provide excellent signal fidelity on all recording components through the use of a small sensor package that is decoupled from the main tool body, further reducing noise.

Advanced software ensures a high level of interactivity during acquisition, it then provides automated quality control and processing that deliver data in time to impact drilling decisions. 'This combination will allow the customer to quickly acquire borehole seismic with complete confidence in the quality of the data,' states the company.

According to Olivier Peyret, Vice President, Schlumberger Reservoir Evaluation–Wireline: 'Q-Borehole technology paves the way for the efficient acquisition of complex borehole seismic surveys that have previously been considered uneconomic or impractical.'

Tel: +1 281 285 4270 www.slb.com

World first for Tronic electrical instrumentation feedthrough system

Tronic, a subsidiary of oilfield services company Expro International, reports that it recently completed a new electrical instrumentation feedthrough system for what is claimed to be the world's first 15,000 psi horizontal subsea tree – located on the Conger field in the Gulf of Mexico.

Manufactured from enhanced materials, the subsea electrical feedthrough system has been designed to carry a signal from a downhole pressure and temperature transducer (DHPPT) at the bottom of the well bore, up through the tubing hanger tree block and into the subsea electrical penetrator. The system also provides a dedicated earth for the gauge signal. The feedthrough system utilises high integrity components comprising a drymate plug and receptacle connection and an internal penetrator. The wet-mate single pin connector pair allows for connection and reconnection of the system when necessary.

High-integrity sealing is provided and consistent mating is ensured due to the wet mateable plus connection allowing for significant levels of misalignment, states the company.

The company also states that subsequent orders for the 15,000 psi electrical feedthrough system will ensure reduced lead times and logistics, as the connectors and penetrators within the



system can be individually tested without bonnet assembly.

Tel: +44 (0)1224 214600 Fax: +44 (0)1224 770295

Membership News

Where do I belong?

Given the changes within the industry in recent years, together with the mobility of people, our Branch committees are sometimes unable to contact Members because they are allocated to the wrong Branch. This arises where people live in one area but work in another. Obviously we are very keen to ensure that Members participate in the activities of their preferred Branch, and you now have the chance to choose the Branch with which you wish to be associated. Just fill in your details below and return it to us by mail o fax +44 (0)20 7255 1472 (photocopies of this page will be accepted), or e-mail your choice to membership@petroleum.co.uk (stating your full name and membership number).

Name (please print in full)

Membership no: _

Preferred branch no: _

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1	3	Edinburgh/	11	North Fast
		SE Scotland	12	Northern

NEW CORPORATE

Essex

Irish

Humber

London

Malta

13

14

15

16

17

South Wales

West of Scotland

Southern

Stanlow

Yorkshire

4

5

6

7

8

Joboil Ltd, 10–16 Tiller Road, London E14 8PX, UK Tel: +44 (0)20 7345 5148 Fax: +44 (0)20 7987 0176 e: jobs@joboil.com www.joboil.com

Representative: Andrea Midas, Marketing Manager A unique, Internet-based oil industry recruitment service. We provide access with a 48-hour response time for employers seeking candidates for temporary or permanent positions. We also provide an online editing and update facility for job candidates for maximum impact job-hunting.

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IP Discussion Groups & Events

Energy, Economics, Environment

A series of four presentations on

'The Late Life of the North Sea'

14 Sept – North Sea strategies and scenarios, by Tom Windle, Ariadne Business Consultants

9 Oct – Shearwater, the management of a major capital intensive project, by John Stubbs, Project Director, Shell Expro (to be held at Imperial College)

24 Oct – The fiscal system needed for the next 25 years of the UKCS, by Christine Wheeler OBE, CW Energy Tax Consultants

16 Nov – Changes in the banking paradigm, by Colin Bousfield and Kevin Price, Barclays Capital

IP contact: Jenny Sandrock

Energy, Economics, Environment Discussion Groups Please notify the contacts if you plan to attend any of the advertised events All events will take place at the IP unless stated otherwise Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, UK Tel: +44 (0)20 7467 7100 Fax: +44 (0)20 7255 1472 e: jsandrock@petroleum.co.uk



Information for Energy Group

Your Future in Your Hands – Selling Yourself and Your Services

Afternoon Seminar, 2pm to 5pm, Thursday, 7 September 2000 Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR

Learn how to develop your potential! Speakers will include: Chris Senior, The Engineering Council; John M Wilson, JMW Mosaic Limited; Sheila Pantry, OBE Information Management Consultant; and Diana Edmonds, Instant Library.

Further information from Catherine Cosgrove, Vice Chairman, IFEG 61 New Cavendish Street, London W1M 8AR, UK. Tel : +44 (0)20 7467 7111 Fax: +44 (0)20 7255 1472 e: lis@petroleum.co.uk



IP Conferences and Exhibitions

International Seminar on Opportunities for Foreign Participation in the

Nigerian Oil and Gas Industry London: 5 October 2000

Organised in co-operation with the Nigerian law firm Okonjo & Okonjo and supported by Inter-Consulting, and Trade Partners, UK. The seminar will focus on upstream, downstream and oil services sectors. The speakers include:

- Peter Ellis Jones, Director, Tawe Oil Managements
 Dr Rilwanu Lukman, Special Adviser to the President
- of Nigeria on Petroleum Resources and Energy, and Secretary General, Opec Aret Adams, former Special Adviser to the Head of
- State of Nigeria on Petroleum Resources and Energy, and former Group Managing Director of the NNPC
- Jackson Gaius-Obaseki, Group Managing Director, NNPC

International Conference for the Oil and Gas Industry on

Successful E–Commerce Strategies

London: 8 November 2000

The IP invites you to attend this timely conference which brings together experiences from a leading international panel of industry users, software providers and on-line exchanges. It will offer practical advice and guidance which will enable you to identify the benefits of using ecommerce, understand how it can enhance your position among other market players and become one of your key business tools.

Speakers include representatives from: BP BIM BIM IndigoPool.com Cracle Straco

Brochure with full conference programme is now available

IP Awards Lunch

London: 13 November 2000

Guest of Honour and Speaker: Lord Levene of Portsoken KBE, Chairman, Investment Banking Europe, Deutsche Bank AG

Responding to the Challenge of the New Economy

For nearly a century, the IP has encouraged and facilitated technical excellence in an industry that prides itself on attaining the highest possible standards. We are, therefore, uniquely placed to acknowledge outstanding new initiatives and examples of good practice within the international oil and gas industry. For the first time this year the IP, in association with Wood Mackenzie, will present seven



awards at this prestigious IP event. In addition, there will also be a unique opportunity to hear an internationally renowned figure speak on issues influencing our global industry today.

It is expected that many companies will purchase tables and maximise the opportunity to entertain guests at one of the key social events in the industry year.

The ticket application form is now available.

- Salisu M Liadi, Director, Privatisation Bureau of Public Enterprises
- Juste Rwamabuga, Manager, Infrastructure & Privatisation Division, African Development Bank
- Hakeem Belo-Osagie, Chairman, United Bank of Africa plc
- Sena Anthony, Group General Manager, Corporate Secretarial and Legal Division/Secretary to the NNPC
- JK Naiyeju, Accountant General of the Federal Republic of Nigeria, and former Chairman of the Federal Board of Inland Revenue
- Patrick Okonjo, Principal Partner, Okonjo & Okonjo, Barristers, Solicitors & Legal Consultants

Conference programme available now!

North Sea: Current Developments in Upstream Issues

Aberdeen: 23 November 2000

This half day seminar organised to coincide with the IP Aberdeen Branch Annual Dinner will discuss the economic aspects and technical solutions employed in the North Sea operations.

Speakers include: Professor Alex Kemp, Aberdeen University.

Interspill 2000 Brighton, UK: 28–30 November 2000

A major conference and exhibition featuring the activities of the European spill response, both at sea and on land, under the direction of the British Oil Spill Control Association and organised by the IP.

Interspill 2000 will be of interest to:

Port and harbour authorities Oil, chemical and transport industries Offshore oil field operators Central and local authorities Emergency services National and international environmental agencies

Brochure with full conference programme is now available

The Role of Alternative Dispute Resolution

London: 4 December 2000

This timely conference will examine a range of perspectives on Alternative Dispute Resolution from the viewpoint of oil company legal departments as well as from some of the leading practitioners in international energy contentious business within the profession. The conference will conclude with a mock mediation which will demonstrate the use and procedures of mediation for those unfamiliar with this form of dispute resolution.

For further information on any of the above conferences please contact: Pauline Ashby at the IP Conference Department Tel: +44 (0)20 7467 7100 Fax: +44 (0)20 7255 1472 e: pashby@petroleum.co.uk or view the IP Web Page: www.petroleum.co.uk

VENT Forthcoming

SEPTEMBER 2000

Prague, Czech Republic 4-7 Pipeline Rehabilitation & Maintenance **Details: Energy Logistics** International Ltd Tel: +44 (0)1628 671717 Fax: +44 (0)1628 671720 e: enquiries@energylogistcis.co.uk

10-14

Dubai, UAE

World Fiscal Systems for Oil & Gas Details: The CWC Group, UK Tel: +44 (0)20 7704 6161 Fax: +44 (0)20 7704 8440 e: bookings@thecwcgroup.com www.thecwcgroup.com

11-13

Cranfield, UK

Calibration of Flowmeters Details: Cranfield University, UK Tel: +44 (0)1234 754766 Fax: +44 (0)1234 751875 e: pase@cranfield.ac.uk

11-15

Oxford LPG – Supply, Economics, Markets and International Trading

19-22

Oxford International LPG Trading and Pricing - Supply, Shipping, Contract and Risk Management

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Oxford LPG Direct Marketing, Operations and Safety Details: The College of Petroleum and Energy Studies, UK Tel: +44 (0)1865 260211 Fax: +44 (0)1865 791474

13-14

Barcelona

Belgium

Iberian Energy Details: SMi Ltd, UK Tel:+44 (0)20 7252 2222 Fax: +44 (0)20 7252 2272 e: customer services@smiconferences.co.uk www.smiconferences.co.uk

14-15

London World LNG Summit Details: The CWC Group, UK Tel: +44 (0)20 7704 6161 Fax: +44 (0)20 7704 8440 e: bookings@thecwcgroup.com www.thecwcgroup.com

18-20

16th International Conference on Fluid Sealing Details: BHR Group Ltd Tel: +44 (0)1234 750422 Fax: +44 (0)1234 750074 e: fluid@bhrgroup.co.uk

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Houston Subsea Houston 2000 Details: Quest Offshore Resources Inc, US Tel:+1 281 493 6180 Fax: +1 281 496 3564 e: SubseaHouston@guestoffshore.com

20-22 Zaragoza, Spain

2nd PowerExpo International Energy Exhibition and Latin American Energy Conference Details: PowerExpo, Spain Tel: +34 976 764700 Fax: +34 976 330649 e: comunicacion@feriazaragoza.com www.feriazaragoza.com

20-22

Aberdeen Environmental Decision Making Details: Cordah Ltd, UK Tel: +44 (0)1224 414211 Fax: +44 (0)1224 414250 e: jbutler@cordah.co.uk

25-28

Planning & Economics of **Refinery Operations** Details: Nick Wilkinson, The Institute of Petroleum

26-27 Istanbul, Turkey

3rd Annual Gas & Power in Turkey Details: IBC Global Conferences Ltd, UK Tel: +44 (0)20 7453 5491 Fax: +44 (0)20 7636 6858 e: cust.serv@informa.com

26-28

Bahrain

Middle East Petrotech 2000 **Details: Overseas Exhibition Services** Ltd, UK Tel: +44 (0)20 7862 2071 Fax: +44 (0)20 7862 2078 e: aiones@montnet.com www.montnet.com

27-29

Cape Town

Africa Upstream 2000 Details: Global Pacific & Partners, South Africa Tel: +27 11 782 3189 Fax: +27 11 782 3188 e: global.pacific@pixie.co.za

27-29 **Dresden, Germany** Synthesis Gas Chemistry Details: DGMK www.dgmk.de/termine.htm

OCTOBER 2000

1-4 Florida International Symposium for Engineering Information Technology Details: Cadcentre Inc, US Tel: +1 302 427 8600 www.iseit.com

1-4

SPE Technical Conference & Exhibition Details: Sensa, UK Tel: +44 (0)1264 337766 Fax: +44 (0)1264 337765

Oxford

Dallas

2-6 The Bunker Industry - A Challenging Approach to Today's Training Needs Details: The College of Petroleum and Energy Studies, UK Tel: +44 (0)1865 260203 Fax: +44 (0)1865 791474 e: jenny@colpet.ac.uk

3-4

London Engineering Asset Management 2000 Strategies for Operational Excellence Details: ERA Technology Ltd, UK Tel: +44 (0)1372 367021 Fax: +44 (0)1372 377927 e: beverley.dunham@era.co.uk

3–5 IOCE Subsea 2000 Aberdeen Details: PGI Spearhead Tel: +44 (0)20 8949 9222 Fax: +44 (0)20 8949 9868

4 London

Offshore Energy Insurance Technology and Law Details: BPP Technical Services Ltd, UK Tel: +44 (0)20 7436 7500 Fax: +44 (0)20 7436 2112 e: t.hutchings@bpp-tech.com www.bpp-tech.com

E **Opportunities for Foreign** Participation in the Nigerian Oil and Gas Industry Details: Pauline Ashby, The Institute of Petroleum

Bedford, UK

Flow Measurement Update Details: Cranfield University, UK Tel: +44 (0)1234 754766 Fax: +44 (0)1234 751875 e: pase@cranfield.ac.uk

Dubai 8-9 Petroleum Trading and International Law Details: Abacus International, UK Tel: +44 (0) 1953 497099 Fax: +44 (0) 1953 497098 e: information@abacus-int.com www.abacus-int.com



The Board of the Shell Transport and Trading Company plc has appointed **Luis E Giusti** to the position of non-Executive Director with effect 13 September. Giusti previously held the position of Chairman and CEO of state oil company Petroleos de Venezuela until last year. He currently serves as a Senior Advisor at the Centre for Strategic and International Studies in Washington DC and also acts as a consultant in oil and energy.

Stuart Cornthwaite, Managing Director of S J Bargh Ltd has been elected Chairman of the Transport Association. S J Bargh has been a member of the Transport Association since 1979.

Leading Oil & Gas Industry Competitiveness (Logic) has appointed **David Inglis** as Supply Chain Adviser with responsibility for raising awareness of the importance of effective supply chain management. Prior to joining Logic Inglis ran his own management consultancy providing marketing analysis and business development assistance to SMEs in the oil and gas and fibre-optic cable industries.

Halliburton Chairman and Chief Executive Dick Cheney resigned on 16 August to accept George W Bush's invitation to be his Republican Party Vice Presidential running mate. David J Lesar has been named Chairman, President and Chief Executive. Lesar has also been elected to the Board of Directors of Lyondell Chemical



Lawrence D Sullivan has joined Ronnington-Petter as Regional Sales Manager for Petroleum Products in the Eastern USA and Canada, Middle East, Africa and India. He will be responsible for the development of Reactogard[™] and other company systems and services to the oil and gas industry as well as petrochemical markets.

Chevron Energy Solutions, a new unit launched by Chevron Products Co, has named **James C Davis** as President. Davis was formerly Senior Vice President, integrated services of the retail energy services unit of PG&E Corp.

Michael E Wiley has been elected Chairman, President and Chief Executive of Baker Hughes Inc, following the resignation of Max L Lukens in January this year. Wiley served as Arco's President and Chief Operating Officer until its sale to BP Amoco plc.

Exploration Consultants Ltd has appointed **Michael S Lucas** as Marketing Manager of the company's Houston office. Lucas will be responsible for marketing ECL's worldwide services in addition to providing clients with high-quality operational support.

Tony Blair has appointed Jonathon Porritt as his key adviser on sustainable development. Porritt will Chair the new Sustainable Development Commission, which will promote sustainable development across all areas of the economy and build agreement on ways of accelerating progress.

Peter Fretwell has joined International Pipeline Products Ltd as Export Sales Manager. He replaces **Ian Anderson** who has been promoted to UK/North Sea Sales Manager. Chairman of the Royal Dutch/Shell group, Mark Moody-Stuart, has been appointed Co-Chair of the G8 Renewable Energy Taskforce. Moody-Stuart will share the chairmanship with Corrado Clini, Director General of the Environment Ministry in Italy.



BG Group plc has announced Board appointments for the two groups to be created out of its proposed demerger - BG International and the Transco Group. BG International has announced the appointment of Frank Chapman as Chief Executive Designate and Richard Giordano will remain as Non-Executive Director. Upon the demerger becoming effective, William Friedrich will be appointed to the Board as Deputy Chief Executive and Keith Mackrell will become Non-Executive Deputy Chairman Designate. The company has also appointed Andrew Bonfield as Finance Director Designate. The Transco Group has announced the appointment of Phil Nolan as Chief Executive Designate. Dr John Parker will become Non-Executive Chairman Designate and Steve Lucas becomes Finance Director Designate. There are four new Non-Executive Directors to be appointed from outside the BG Group: Sir David Davies, President of the Royal Academy of Engineering; Kenneth Harvey, Chairman of Pennon Group plc; George Rose, Finance Director of BAE Systems plc and; Baroness Warwick, Chief Executive of the Committee of Vice Chancellors and Principals.

Global Marine Inc has announced that **Blake Simmons** has been promoted to President and Managing Director of Global Marine UK Ltd in Aberdeen. Simmons will be responsible for all of the company's international contract drilling operations in the UK and overseas. **Mark Monroe** was named Vice President of Sales and Contracts for Global Marine Drilling Company to succeed Simmons. Also promoted was **Aldert Van Nieuwkoop** to Vice President of Sales and Contracts for Global Marine UK Ltd.

Corporate Vice President and Treasurer of Chevron Corp George K Carter has decided to retire after a career spanning 40 years in financial management. Carter will be succeeded by David M Krattebol currently serving as President of Chevron San Jorge in Buenos Aires, Argentina. In a separate action, Corporate Comptroller Stephen J Crowe has been named a Corporate Vice President reflecting his outstanding contributions and expanded functional responsibilities.

ABB, the global technology group is combining its UK companies to create a single customer-driven industrial IT organisation. The new operation will be known as ABB Automation Ltd. David Denton, currently in charge of automation activities has been appointed Managing Director. Mike Mason, currently in charge of instrumentation ortivities will take of S



activities, will take the role of Sales and Marketing Director responsible for Strategic Accounts.



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