

DECEMBER 1993

The Institute of
Petroleum



PETROLEUM REVIEW

Middle East

Gulf gas becomes
tomorrow's nest-egg

Turkmenistan

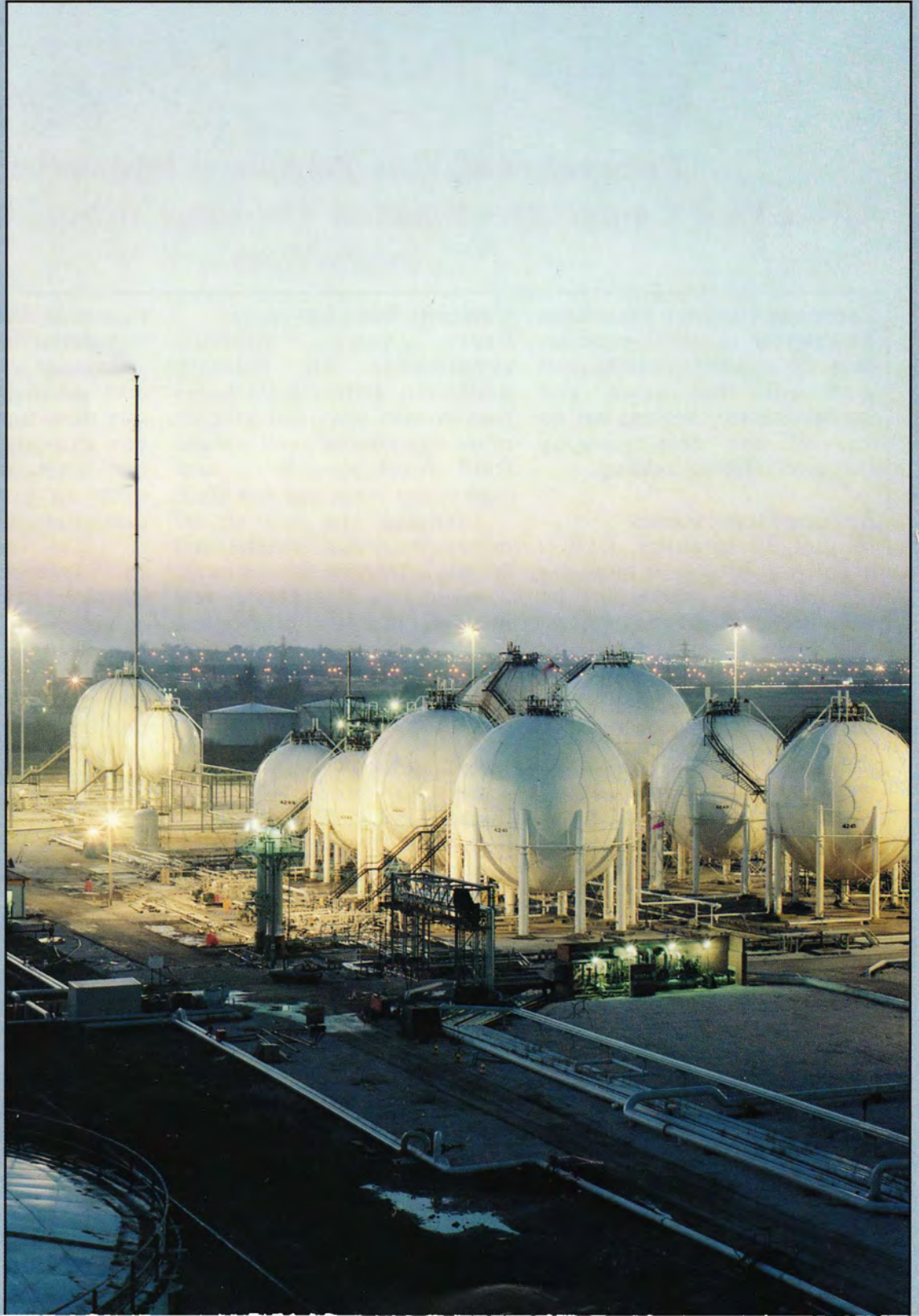
An update on
developments in the
oil and gas sectors

Investment

The risk of
underinvestment
in energy

Measurement

Coriolis mass
metering on LPG
road vehicles





THE INSTITUTE
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Cover photo: Shell Stanlow. Photograph courtesy of Whessoe plc

27 October

Highland Fabricators of Nigg and Trafalgar House of Teesside have been selected as building contractors for the BP Andrew field. Highland will construct the 7,500 tonne jacket and Trafalgar, the 10,500 tonne integrated deck.

Texaco is to explore three East China sea blocks covering over 8,000 sq kms, almost doubling its total exploration area in the country. The company will act as operator, in partnership with Agip and Maersk Oil.

A Norwegian oil tanker has exploded off the coast of Trinidad killing five people.

Energy Minister Tim Eggar has announced the membership of the government's new Energy Advisory Panel. Chaired by Dr Martin Holdgate, it will advise on the information to be contained in next year's Energy Report.

28 October

Six Japanese oil companies, Nippon Oil, Idemitsu Kosan, Cosmo Oil, Nikko Kyodo, Showa Shell Sekiyu and Mitsubishi, have denied newspaper allegations that they formed a cartel on oil product prices.

The former Soviet republic of Moldova has announced plans to construct an oil terminal on the River Danube.

29 October

BP has withdrawn its staff from Algeria after a series of kidnappings and assassinations of expatriates in the country by Islamic radicals. Total, Occidental and Anadarko are also evacuating personnel.

31 October

An international consortium of eight Western oil companies, including BP, has reached a provisional agreement with Azerbaijan to develop its Caspian sea reserves. £5 billion is to be spent on the Chirag and Azeri fields but Guneshli has been excluded from the deal.

1 November

Amerada Hess has discovered oil with the first well to be drilled on block 21/16 in the Central

Graben. The block was taken over from Unocal in March.

Lloyd's of London has been commissioned by unnamed US oil concerns to study environmental and navigational safety in the Bosphorus.

2 November

Amec Engineering has won a £60 million contract to update BP's Grangemouth refinery in Fife. The work will involve the installation of a hydrofiner unit, designed to meet new EC limits on the sulphur content of automotive diesel fuel.

3 November

Texaco is being sued for more than \$1 billion by a group of Ecuadorian Indians who claim the company polluted their water supply while operating wells in the Amazon basin during the 1980s.

Forcenergy of Sweden is to purchase 13 US oil and gas fields for \$32 million, increasing its total production by over a third.

8 November

A new \$4 billion refinery is to be built in Huizhou by the China National Offshore Oil Corporation (CNOOC), in a joint venture with Royal Dutch/Shell. A CNOOC subsidiary, China Offshore Oil (Singapore) International, will also be established to procure crude for the refinery.

Elf Petroleum Norge AS has awarded the Froy tie-ins contract to Stena Offshore, further strengthening the subsea company's position in Norway.

Conoco has launched an attack on the level of cover provided to the oil industry by insurers and has warned that future projects, such as the Britannia field, could be affected.

9 November

Enron has won a bid to partner Yemen in a planned LNG export project, according to the *Middle East Economic Survey*. The company was chosen above Total SA and the Hunt Oil/Exxon Corp consortium.

Chevron UK has placed orders

totalling £24 million with Centrilift and Lasalle Engineering to lease electrical submersible pumps and ancillary equipment for the Alba and Ninian oilfields.

Foster Wheeler has been appointed as project management consultant for stage one of the Petronas Second Refinery Sour Train (PSR-2). The \$1 billion contract, awarded by the Malaysian Refining Company, is to establish the basic engineering design for the refinery.

10 November

Singapore's Sembawang shipyard has won a major construction contract from Arco for work on the Yacheng 13-1 natural gas development in the South China Sea.

National Power has warned it may be forced to close 10 coal-fired power stations by 2000.

Norsk Hydro and EniChem Agricoltura are to form a joint venture to run their southern European fertiliser activities. The venture, which will employ some 800 staff, is expected to reach first year sales of \$487 million.

11 November

ScotOil Services was fined £1,500 at Aberdeen Sheriff's Court after pleading guilty to breaches of health and safety. The court heard how employee, Mr Leslie Knox, was asphyxiated when a 750kg metal grid slid to the ground, trapping him.

John Wood Group and Foster Wheeler have joined forces to acquire almost all JP Kenny's engineering companies. The new firm, JP Kenny Engineering, will not include the Group's operations in the Former Soviet Union.

The introduction by the Nigerian government of a seven-fold increase in the price of fuel has been blocked by the High Court in Lagos.

12 November

BHP Petroleum has finalised its purchase of Conoco Australia which will enhance its interests in the Caernarvon

Basin and the Timor Sea.

14 November

Chevron has confirmed it will be stopping all exploration activity off the Western Isles.

15 November

Elf has announced production start-up from the Hylia and Vanneau fields, off the coast of Gabon. Combined reserves are estimated at 44 million barrels.

Australian oil companies are stepping up their offshore exploration activities in order to combat falling production, according to the Australian Petroleum Exploration Association.

16 November

Talks have begun between Iran and India over plans for a natural gas pipeline linking the two countries.

OPEC's outgoing chairman, Mr Jean Ping, has criticised Britain and Norway for allegedly ignoring pleas to cut production.

Powergen announced it is to purchase a £45.5 million stake in the Liverpool Bay oil and gas fields from Monument.

17 November

BP Nutrition revealed it expects to reach agreement over the proposed sale of Paragon Petcare to the food and agriculture group, Dalgety, by the end of the year.

Norske Shell has revealed that a leaking storage tank on the Draugen concrete oil platform resulted in a 36-hour shutdown and the loss of one million tonnes of crude.

Kuwait has reopened its Shuaiba refinery, which was virtually destroyed during the Gulf War.

18 November

Energy Minister Tim Eggar has announced Annex B approval for the Medwin field.

The Queen's Speech has revealed that the government plans to introduce legislation to privatise British Coal.

Upstream Atmospheric Emissions

17 February 1994

To be held at the Institute of Petroleum

This conference aims to present the methodology used to obtain the results of the Halliburton Study to quantify the emissions from the upstream industry to cover all the offshore installations and their associated onshore facilities, to discuss their significance and to demonstrate that, one year on from the Consultative Conference, the industry has made progress in improving the methodology/measurement techniques and has a strategy for reducing overall emission levels.

The following papers will be presented:

- ▲ Global Climate Change – The Uncertainty
- ▲ UK Government and IPCC Perspectives
- ▲ The Halliburton Study – Methodology and Results
- ▲ UKCS Emissions – An Overview of the Results and Management of the Reduction Strategy
- ▲ A New Approach for Estimating Atmospheric Emissions
- ▲ The Measurement of Atmospheric Emissions

For a copy of the registration form, which will be available shortly, please contact Caroline Little, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR, UK. Tel: (071) 636 1004. Fax: (071) 255 1472.

Information for Energy Group

7th OIL PRICE SEMINAR Price Formation Around the World

15 February 1994

To be held at the Institute of Petroleum

PROGRAMME

Seminar Chairman: Mr R Patrick Thompson,
President, New York Mercantile Exchange

Three papers will be presented:

- ▲ Oil Product Consumer Prices within the EC - Past Developments and Trends to Spot
C Peter Regnier, Managing Director, OPAL Oil Price Assessments Limited
- ▲ New Trends for Crude and Refined Products Trade in the Americas
Shirley S Savage, Editor-in-Chief, Platts Oilgram Price Report
- ▲ Pricing the Unpriceable – The Oil Markets of the Asia Pacific
Paul McDonald, Managing Director, Pearl Oil

Exhibits and displays by suppliers of price information will be presented by EMC Energy Market Consultants, Petroleum Argus, Saladin, Telerate and others.

For a copy of the registration form which will be available shortly, please contact Catherine Cosgrove, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR. Telephone: 071 636 1004. Fax: 071 255 1472.

Battle of the forecourts continues

Shell is sticking to its guns over a recent advertising campaign attacking the quality of retail store petrol and has told *Petroleum Review* that its own service stations 'far outclass the relatively basic supermarket filling station offering'.

Its advertisement, which appeared in a series of national newspapers on 15 November, claimed that cheap supermarket petrol without detergent additives causes carbon build-up in engines, resulting in poor starting, reduced power, high fuel consumption and early wear.

It immediately sparked strong protest from the leading supermarkets, with Sainsbury's spearheading the backlash. The supermarket has accused Shell of launching a 'last-ditch attempt to improve its market share' while customers continue to drift towards hypermarkets, which sell fuel up to 15p cheaper per gallon.

A spokeswoman said that Sainsbury's had been offering customers petrol with added detergents in 80 of its 130 outlets since early November and that all its stations would follow suit by the end of the month.

'Shell knows very well what people in the industry are doing - they would have known that we had additives in two-thirds of our filling stations when they placed the ad.'

In this latest war of words, Sainsbury's has said its decision to introduce detergent additives came after a 'recent recommendation' by the major motor manufacturers. However, according to Shell, 'it has been well known for five years that petrol lacking detergents is bad for engines'.

Sainsbury's has also said it would have introduced petrol with additives sooner had it been able to obtain them. 'We had long-term contracts and we don't believe in cutting out our suppliers',

said a spokeswoman.

However, in an interview with *The Grocer* on 2 October 1993, Sainsbury's is quoted as having said: 'We believe the case for additives in fuel is yet to be fully proven and any customer benefits are imperceptible. In fact, putting detergents in fuel has been an oil company marketing ploy for a number of years.'

According to Shell, 'Sainsbury's could have added these detergents at any time during the last five years or so.'

Meanwhile, Sainsbury's, together with other supermarkets and some oil companies, has accused Shell of basing their advertising campaign on a biased survey.

Conducted by Ricardo Consulting Engineers and printed in *The Times* on 22 October, they have pointed to the fact that Shell both arranged and paid for the survey. Shell insists, however, that Ricardo's examination was 'completely independent'.

Integration for Theddlethorpe gas terminal

Enormous improvements to flexibility and efficiency were introduced last month to the Theddlethorpe gas terminal on the Lincolnshire coast.

Operated by Conoco (UK) Ltd and owned jointly with BP, the terminal, which delivers roughly a quarter of Britain's gas requirements, has now been integrated physically. Previously there were four processing facilities and four pipeline systems - now they are linked and completely interchangeable. This allows the mixing of the various gas streams arriving at the terminal from 12 different fields. Henceforth there will be one stream of gas which can be allocated to any of the 40 supply companies that take gas from Theddlethorpe.

In future the operator will

be able to supply gas to a standardised specification, now to be measured thermally instead of volumetrically. This results from the ability to combine, blend or substitute different types of natural gas from different fields.

Integration has also involved the standardisation of the contractual arrangements at Theddlethorpe. Since 40 gas production, supply, transportation and marketing companies use the terminal, this was a complex task which took two years. In all, 150 new agreements had to be negotiated and signed.

Integration has contributed to the development of the Caister and Murdoch gas fields, operated by Total and Conoco respectively. These

two fields, producing Britain's first Carboniferous gas, came into production in October. Integration, with the opportunity for blending with gas from other fields, helped to make development viable - otherwise the Carboniferous gas would not have met customer specification with regard to calorific value etc.

The terminal has a processing capacity of 2.6 billion standard cubic feet of gas per day. The average processing rate in 1994 is expected to be less than two-thirds of this figure, leaving considerable spare capacity for the tying-in of new fields and satellites. All gas leaves the terminal by British Gas pipelines, with the exception of supplies destined for Kinetica at Killingholme.

FREE CARBON WITH SUPERMARKET PETROL.



CARBON FREE WITH SHELL ADVANCED PETROL.

In a recent test, the three supermarket petrols with no or a limited amount of detergent failed to clean the engine which was found to have high fuel consumption and early wear. The supermarket petrols were found to have a higher amount of carbon build-up in the engine. The Shell petrol was found to have a lower amount of carbon build-up in the engine. The Shell petrol was found to have a lower amount of carbon build-up in the engine.

Shell's newspaper advertisement

Once this latest episode in the battle of the forecourts has died down (Sainsbury's has already confirmed it is not planning to take legal action against Shell), the most lasting effect is likely to be a speed-up in the general move towards using detergent additives.

Tesco has said it sells high-quality petrol and is now investigating whether there are now benefits to be gained from including the additives in its fuel.

And several oil companies who, although not targeted in Shell's campaign, do not yet use detergents are also 'looking into the situation'.

A spokesman for Mobil, who currently add detergents to premium unleaded and diesel, announced they would be extending this benefit to all unleaded fuel by the end of the year. 'Our petrol is more than adequate for the current passenger car engines but there is a new generation of engines that will require these additives.'

Burmah has said it will not be including detergents until it is confident that their use has been thoroughly tested and there are no detrimental effects to either the vehicles or to the environment. 'If the motorist assesses that there is a definite benefit in using fuel with additives then we will meet whatever customer demand that results from this decision.'

Exploration top priority for Elf Enterprise

Armed with a £45 million exploration budget for 1994, Elf Enterprise Caledonia (EEC) has set itself the high target of finding 100 million barrels of oil in UK waters within the next two years.

Two or three exploration wells are to be drilled in Claymore over the next 18 months and activity will take place both in the English Channel and in the Irish Sea.

Elf currently produces 250,000 barrels a day from its interests in the Piper, Saltire, Chanter, Claymore and Scapa fields in the North Sea.

'Today the sky is blue and the birds are singing,' said EEC Chairman and Chief Executive, Mr Michel Romieu. 'But the problem will come in 1997 when all the fields decline and the costs start to climb.'

He said the company's aim

was 'to be as competitive as the biggest oil firms' and identified its guiding principle as one of 'pragmatism, not bound by dogma.'

'There is a damned good future in the North Sea but it has to be got using creativity, pooled resources and cost rationalisation.'

Mr Romieu confirmed that another 200 production jobs are likely to be axed within the next three years. This will take total staffing levels, already down from 1,670 to 1,400, to 1,200.

Mr Romieu also warned that the Flotta terminal, which currently handles 15 percent of the UK's total North Sea oil output, was 'in real commercial danger.'

'We must reverse a tendency that is lethal. If no new business is found, the

terminal will extinguish itself by the end of the century.'

However, he said efforts were underway to drum up new customers and 'good talks' were currently being held with the Britannia group.

'We will fight to the last drop of blood for Flotta,' he added.



Mr Michel Romieu

BP strengthens Alaskan presence

BP has significantly strengthened its position in Alaska through separate deals with Conoco and Chevron.

The firm has agreed to acquire both Conoco's and Chevron's interests in the Milne Point field, on the North Slope of Alaska. This means it will own 91 percent of the field and become operator.

BP is also to gain interests in 54 mainly deepwater blocks in the Gulf of Mexico from Conoco. In exchange, it will assign Conoco a 33 percent stake in its wholly-owned Gulf of Mexico Amberjack field.

The exchange with Conoco and the purchase from Chevron are expected to be completed by the end of the year.

Fine for safety breach

BP Exploration has been fined £7,500 after a fire on the Forties Bravo installation endangered the life of an oil worker.

Aberdeen Sheriff Court heard how the incident occurred while an export pipeline was being cleaned during a shutdown.

Depute Fiscal Mr Ray Craig said a small fire developed in the export line, when welding sparks ignited some gas. Although it was quickly extinguished, a man working nearby was put in danger.

The court heard that BP failed to ensure that the area downstream from the open end of the export line was properly clear of gas. The company also failed to use either a blocking or isolation device, together with an inert fluid, which would have prevented gas entering the vicinity of the 'hot work' area.

Mr Reg Christie, defending, said the incident arose out of a highly unusual set of circumstances and that there had been no risk of explosion.

Security Council votes for tighter Libyan sanctions

The United Nations Security Council voted last month to impose tighter sanctions on Libya for refusing to hand over two men alleged to have been involved in the bombing of a Pan Am flight over Scotland in 1988 (see *Petroleum Review November issue*).

Since April 1992 weapon sales to Libya have been banned, as well as international aircraft flights and the sale of aviation equipment. These sanctions remain but have now been extended to include further categories of goods and services. However, oil exports remain untouched.

As *Petroleum Review* went to press, UN member states had until 1 December to bring the new measures into force. If the Libyans should decide to comply with the oft-repeated UN request and hand over the two men, the sanctions will not be extended.

This latest Resolution requires the UN to prohibit the export of the following oil-related goods and equipment, as well as any arrangement for manufacturing or maintaining these items:

- Pumps of medium or large capacity;
- Equipment for use in crude oil export terminals, such as loading buoys or single point moorings, flexible hoses or anchor chains;
- Equipment not specially designed for use in crude oil export terminals but which, because of its large capacity, can be used for this purpose — examples include loading pumps of large capacity, booster pumps, pipeline inspection tools and metering equipment of large capacity;
- Refinery equipment such as boilers, furnaces, fractionation columns, pumps, catalytic reactors, prepared catalysts;
- Spare parts for the above.

Other provisions prohibit the supply of materials destined for use on Libyan civilian or military airfields, the servicing of any aircraft within Libya, making available for operation within Libya any aircraft or components, or providing aviation training or insurance for Libyan aircraft.

Further restrictions include a freeze on financial assets belonging to Libya in foreign bank accounts.

The Security Council limited its new sanctions to these measures on the grounds that they will not cause the hardship that an oil embargo would have done. In any case, it is understood that in recent months Libya has been stockpiling crude and products in Europe, importing extra spare parts and moving funds as part of a precautionary move in case sanctions should be tightened.

Valuable Saudi upstream data published

A recent study on Saudi Arabia looks into present levels of oil production capacity and considers how much investment would be needed to maintain and to increase that level.

The report has been produced by the Centre for Global Energy Studies in London, as part of a major research project on oil production in the Gulf.

The volume on Saudi Arabia is of vital interest to many, because of the Kingdom's status as the largest OPEC producer and the owner of the largest proved oil reserves in the world.

After the Iraqi occupation of Kuwait, the Saudis raised their output by 3 million barrels per day (b/d) to around 8.5 million b/d.

Observers want to know whether this level is sustainable and whether it is realistic to expect a return to the previous top level of 10 million b/d or even higher by the end of the decade.

The study is very detailed, analysing the upstream sector field by field. A comprehensive databank has resulted from this work, providing much up-to-date information that was previously not available publicly. The report comprises more than data and information. Past performance and future development of each field are discussed and evaluated. Facilities are also considered in great detail and future plans presented and discussed.

The report concludes that

Saudi Arabia's present crude production capacity is now around 9.6 million b/d, excluding the Neutral Zone, and could reach 10 million b/d. To maintain it at these levels would require capital investment of \$1.5-2 billion annually. To increase capacity would require capital expenditure of \$0.25-1 billion annually.

The study also analyses output levels of the various grades of crude. It shows that the lighter crudes acted as the main swing producer from 1980 to 1990 (when output and exports fluctuated considerably). The report's author believes that these lighter crudes are likely to continue to fill this role in future years, should demand fluctuate.

Kvaerner buys two more UK firms

The Kvaerner group has purchased two more British offshore engineering firms in a bid to further strengthen its hold on the UKCS services and delivery market.

The new acquisitions, Aberdeen Marine Oil Development (AMOD) and McAlpine Humberoak, cost £4.7 million and will form the basis for a new offshore operation to be called Kvaerner Oil & Gas Services (KOGS).

With its headquarters in Aberdeen, the company will employ almost 800 people. This is in addition to the 750 already employed by Kvaerner in Croydon and London.

The move comes less than two years after another major spending spree by the Norwegian group in which it purchased the UK onshore and offshore engineering businesses of Humphrey & Glasgow and Earl and Wright for £15.5 million.

Headed by Mr Arnfidd Orten (48), the new offshore operation will also be taking over branches of AMOD and McAlpine Humberoak at Lowestoft and Heysham.

'The company will offer a full range of products and services to the UK shelf and eventually the international market,' said a spokesman.

Japan steps up investment in North Sea

Mitsubishi Oil is to acquire a \$200 million package of UK North Sea interests, the latest in a line of Japanese conglomerates to invest in the sector.

In what is almost certainly the largest Japanese North Sea investment to date, the firm has purchased shares in the Andrew and Eastern Trough Area Project (ETAP) fields from Petrofina. It has also acquired interests in a number of the Belgium firm's exploration blocks.

The deal, which is subject to approval by both the UK and Japanese governments, follows Itochu's purchase last February of Enterprise interests in the Hudson, Hutton and Northwest Hutton fields worth over \$100 million. Two other Japanese firms, Nippon Oil and Sumitomo, already have stakes in the North Sea.

For Mitsubishi, the move is part of a drive to add to its international portfolio which already includes Papua New Guinea, Canada and Vietnam. It also signals a desire to develop as an

integrated oil company by expanding its upstream activities, which until now have firmly taken a backseat to its core refining and marketing business. The company currently owns four refineries and more than 4,500 service stations in Japan. In 1992/93, it imported 125 million barrels of crude oil.

The Fina interests will be purchased via a planned joint venture company between Mitsubishi and Japan National Oil.

The attractiveness of the assets, which include a 12 percent stake in the Andrew field and a five percent stake in the ETAP blocks, is said to be Britain's stable political and tax regime and highly-developed infrastructure. The recent PRT changes have further added to the desirability of the region.

'The near-term development of Andrew, compared with the longer term development of the ETAP blocks and the exploration opportunities mean we are also acquiring a well-balanced

package', said a spokesperson.

Mitsubishi's commitment contrasts with the decision by three leading Japanese oil refiners just days earlier to cancel a \$9.25 billion joint venture with Saudi Arabia. Nippon Oil, Nikko Kyodo and Arabian Oil are said to have pulled out in response to Japan's economic slowdown.

The deal would have allowed Aramco to break into Japanese oil refining and sales and Japan to secure a stable source of oil.

Forecourt contractors in safety drive

Britain's forecourt contractors have formed an association with the aim of enhancing safety at service stations.

The Forecourt Contractors Safety Association (FCSA) plans to provide training programmes and certification and monitoring procedures for contractors carrying out construction and maintenance work at stations.

Members will be encouraged to develop

uniform and consistent safety strategies according to the requirements of the IP's Code of Practice.

The association, which also aims to keep abreast of technical developments within the industry and any EC legislative changes, will work closely with the Association of Forecourt Systems Contractors and will attend regular meetings of the IP Panel 'A' Committee.

Gulf gas – tomorrow's nest-egg

By John Roberts

The Persian Gulf remains the world's largest crude oil reservoir but it also contains some of the world's biggest gas reserves and for much of the 1990s the countries that grew rich on the oil booms of the 1970s and 1980s will be seeking to develop their gas resources as well as their oilfields.

At present, these are remarkably under-developed. For while the region's OPEC oil producers – Saudi Arabia, Iran, Iraq, the UAE, Kuwait and Qatar – together with Oman and Yemen, possess between them some two-thirds of the world's oil reserves and do not produce anything like such a proportion, they do at least account routinely for around 27 percent of global oil output. OPEC member states are completely free to develop their gas resources, whereas oil production levels are currently governed by ceilings set by OPEC. As a result there is considerably more scope for expansion in the gas sector than in oil.

Bountiful gas reserves

This same group of countries contains five of the world's top gas producers who between them own around one-third of the world's proven gas reserves. Yet their gross production in even a good year only amounts to less than 7.5 percent of routine world output, while actual marketed production, what is left over after flaring and reinjection, accounts for barely 5 percent of world output.

Overall, these eight producers possess, between them, around 53,000 billion cubic metres (bcm) of declared gas reserves. This figure is somewhat larger than commonly cited estimates for proven reserves as a result of recent statements by Iranian, Qatari and Omani officials concerning the extent of their country's reserves as a result of

ongoing exploration programmes. If the increases announced by these three countries are taken into account, then world reserves, estimated by OPEC at 142,000 bcm in 1991 should, perhaps, be revised upwards by around 10,000 bcm.

All the states of the region now appear to understand the importance of gas as a further source of domestic or foreign income. Iran, Qatar and Oman have all embarked upon ambitious gas development projects which will considerably raise the profile of Gulf producers in the world gas industry before the end of the century. The UAE is expanding its gas facilities, while Yemen is contemplating its own gas megaproject. Saudi Arabia is looking to gas as the favoured fuel for domestic power generation, leaving only Iraq and Kuwait with little prospect of major developments in their gas industries in the immediate future.

What follows is a summary of major developments in the Arab states of the Gulf and the Arabian peninsula. Iran, with its own well-established export programmes, and major internal reliance on gas for domestic industry and power, is not being considered in this report.

Qatar

Qatar has no less than three major projects on hand at the moment. There is the original Qatargas project by which Qatar is due to supply Japan with an initial 2.5 million tonnes per year (mtpy) of LNG in

1997 rising to 4.0 mtpy in 2000. Japan's Chioda in July was the low bidder for the \$1.4 billion project, which may yet be expanded with the addition of a third train to take capacity to a total 6.0 mtpy.

The second project is intended to produce up to 10 mtpy at Ras Laffan. Mobil has taken a 70 percent stake in this project, which is supposed to come into operation barely a year after the 1997 opening of the Qatargas project. The principal customers for Ras Laffan will be Korean power generators, although the Chinese Petroleum Corporation has just signed a letter of intent to take 2.0 mtpy, while the Ras Laffan partners are also actively seeking Japanese and Taiwanese custom. Last April the US Enron signed a preliminary agreement to purchase 2.5 mtpy of LNG from Ras Laffan for a combined cycle gas turbine plant which it is helping to build in the Indian state of Maharashtra.

Under a third project, Qatar is looking to supply Italy with between 8.0 and 12.0 bcm of LNG per year from around 2000 onwards. Qatar last year signed a contract for this Eurogas project with Italy's SNAM to study the project, with a group headed by Texan energy entrepreneur Nelson Bunker Hunt holding a 5 percent stake. This is, in effect, a country-to-country deal, as SNAM is Italy's state-owned gas company and the principal purchaser is to be Italy's state-owned electricity authority ENEL. However, it is not clear whether the project will be able to

generate sufficient initial income from planned condensate production to cover key establishment costs, particularly amidst reports that the Italians may be somewhat strapped for cash as a result of government plans to privatise both SNAM and ENEL. A privatised structure for ENEL may also imply reduced demand for imported gas by Italian customers.

The lacklustre state of European economies, Qatar's relative lack of the kind of massive reserves required for indigenous funding and the consequent need to raise capital on commercial markets and question marks over demand make it unlikely that all three projects will proceed quite as smoothly as appeared to be the case at the start of the year. The Eurogas project looks particularly vulnerable – it is competing for funds with a series of domestic gas-based industrial projects which would yield quicker financial returns. Lack of capital is also one of the main reasons why Qatar has not been able to finalise its cherished project of a gas pipeline to Europe. This remains a long-term goal, with Turkey and Southern Europe considered prime customers.

Oman

Oman, where gas was first discovered in 1962, has been using gas to produce electricity for more than 10 years and, indeed, has been steadily transforming older power stations to gas in recent years. But its plans to become a major gas exporter really only began in 1989 with the discovery of a major gas field at Saih Nihayda, with recoverable reserves considered to be as high as 10.0 bcm. Further discoveries in 1991 and 1992 at Saih Rawl and Barik, which could yet prove to be greater than the Saih Nihayda find, have led the country to revise its total gas reserves to 16.8 trillion cubic feet, or around 500 bcm.

In February 1992 the government announced plans for a massive LNG project, with Petroleum and Minerals Minister Said Ahmed al-Shanfari saying that 'Gas will become Oman's second largest foreign exchange earner, after oil, within eight years.' The joint venture to develop the project was formally established in June with the government taking a 51 percent stake and the other shares divided as follows: Shell Gas 34 percent; Total 6 percent; Partex 2 percent; Mitsubishi Corporation 3 percent; Mitsui 3 percent and Itochu 1 percent. The project includes

construction of a 5 mtpy LNG plant at Bimmah, 150 kilometres southeast of Muscat and the first deliveries are scheduled for mid-1999. Costs were initially put at \$9 billion but have now been scaled back to around \$6 billion, with this figure evenly split between the cost of upstream work, construction of the Bimmah plant and purchase of LNG tankers. The main Bimmah design and construction contracts are both provisionally scheduled to be awarded next year but much will depend on the speed with which end-sales agreements are concluded.

Petroleum Development Oman is still carrying out appraisal of the country's gas and condensate reserves in the light of the recent discoveries but such is the government's confidence that natural gas is now becoming the global fuel of choice that the country has decided to press ahead with the project even before the full extent of reserves are known.

At the same time, Oman is also considering utilising its gas for another major export project, the direct delivery of gas by pipeline to India. The Oman Oil Company, the overseas arm of Petroleum Development Oman, signed a preliminary agreement with India in March on a 50 mcm per day line to the Indian west coast to be backed by a 40-year gas supply contract. According to recent reports, the two countries have now decided that they will build the line by the shortest direct route across the northern end of the Indian Ocean instead of hugging the Iranian and Pakistani coastline, one of the initial options.

Oman's Commerce and Industry Ministry said earlier this year that it was considering a plan for a \$700 million petrochemical complex that would seek to exploit the country's gas resources and to produce up to 200,000 tpy of polyethylene and polypropylene.

Yemen

Yemen appears to have chosen the US Enron Corporation to develop its recently-discovered Marib gas fields. Although no final agreement has been signed, the Supreme Petroleum Council has said it will hold detailed negotiations with Enron on a proposed LNG venture which has been costed at up to \$5.5 billion. A consortium of Hunt and Exxon, the two companies which originally developed North Yemen's oil reserves, had hoped to secure the contract, as

had Total. Turkey and India are viewed as prospective customers.

Although Yemen has not conducted anything like a comprehensive assessment of its gas resources, the Marib Jawf basin is estimated to contain 15 trillion cubic feet (about 430 bcm) of gas. The country is also seeking to expand production of LPG for domestic use.

UAE

The UAE was the first Arab Gulf state to develop LNG production facilities and it is currently in the middle of a major gas expansion which should yield substantial dividends by the end of next year. The Abu Dhabi Gas Liquefaction Company (Adgas) should see offshore gas production rise from 600 million cfd to 1,200 mcf by the end of the year. By that time, the expansion of the Das Island LNG plant, currently being carried out by Chiyoda, should be completed. Adgas signed an agreement in October under which the Tokyo Electric Power Corporation is to take delivery 5 million tpy of LNG over the next 25 years. The company is already a major customer of both Das Island LNG and LPG.

Meanwhile gas output is rising steadily. It increased from 18.6 to 20.1 bcm between 1991 and 1992 in Abu Dhabi and from 4.32 to 5.82 bcm in Sharjah. New gas finds at Kahaif make it likely that Sharjah output will see a further surge in mid-1994. Shalco, the Sharjah LPG company, is currently raising capacity of its LPG plant from 440 million cfd to 700 mcf.

Saudi Arabia

Although Saudi Arabia holds the world's fifth largest gas reserves, these are sometimes forgotten in view of the attention paid to Saudi oil. For the time being, the Kingdom seems determined to concentrate on utilising its gas resources for internal purposes, partly to boost power generation and partly for reinjection. It also helps to free up products/crude for export. The Kingdom's reserves are currently estimated at 5,228 bcm, or 3.7 percent of the world's total. This should, perhaps, be considered an underestimate. In February, Oil Minister Hisham Nazer declared that the Kingdom 'has plenty of gas and has discovered what we think is a huge reserve in northern Saudi Arabia.'

The power sector is shifting decisively to gas. Riyadh's planned ninth

power station, with a capacity of 1,200 MW and an optional further 400 MW is likely to be powered by gas turbines. Next year, contracts are expected to be let for the 2,400 MW Ghazlan thermal power plant with combined cycle gas turbines under consideration to provide the 4 x 600 MW units. The existing combined cycle complex at Rabigh is being expanded, as are gas turbine stations at Mecca, Medina, Tabuk, Juf and Abha. This activity has led to suggestions that the near future will witness an ability to process some 4,300 m cu. ft of gas per day. But there has been no announcement to this effect, and it does not appear to be part of the current Aramco oilfield expansion programme.

In the long run, equally important will be the use of gas as feedstock for the country's petrochemical industries. Saudi Arabia's principal industrial group, Sabic, was specifically founded in 1976 to take advantage of the country's reserves of associated gas, and is currently in the middle of a programme designed to take its total output of a variety of products, many of which are either dependent on gas-derived power or on gas feedstock, from 13 mtpy to 20 mtpy. In particular, Sabic is now looking to develop the country's aromatics industry, using a process developed by British and US companies, known as cyclar dehydrocyclodimerisation, which uses LPG to produce such aromatics as benzene, toluene and xylene.

Iraq and Kuwait

Iraq has focused all its efforts on restoring its oil export capacity. But,

	Declared Reserves (bcm)	Gross Production	Marketed Production (mcm)	Domestic	Exports
Iran	** 25,000.0	57,500.0	26,000.0	23,500.0	2,500.0
Qatar	** 10,800.0	10,130.0	9,300.0	9,300.0	nil
UAE	6,658.0	32,940.0	25,940.0	22,500.0	3,450.0
Saudi Arabia	5228.3	64,700.0	32,000.0	32,000.0	nil
Iraq *	3,100.0	11,840.0	6,450.0	2,850.0	3,600.0
Kuwait *	1,500.0	11,100.0	8,160.0	8,160.0	nil
Oman †	500.0**	4,650.0	2,250.0	2,250.0	nil

** Recent national estimates. Latest OPEC figures (1991) are: Iran, 20,000; Qatar 6,428; Oman n/a
* 1989 figures used
† 1992 national figures

Source: OPEC, BP, Central Bank of Oman

should Saddam Hussein's government be replaced by a more moderate regime, it could once again become a significant gas exporter. Iraq possesses the world's 10th largest gas reserves and during the brief intermission between the ending of the Iran-Iraq War and the start of the Kuwait crisis it successfully exported considerable volumes of natural gas to Kuwait. In 1989 these totalled 3,600 mcm, making Iraq the Gulf's biggest gas

exporter. There is every reason to believe that Baghdad will seek to revive this lucrative trade should political conditions ever prove propitious. In this context, however, much will depend on whether Kuwait, which alone of the major oil producers would appear to be suffering from a gas deficit, seeks, in the meantime, to revive pre-crisis plans for the import of gas from other, presumably more friendly, Gulf Cooperation Council states. ■

Wednesday 8 December 1993
5.00 p.m. for 5.30 p.m.

'Trends in Industrial Boiler Firing'

Implications for Oil and Gas Consumption

Speaker - John Chesshire
Senior Fellow, Scientific Policy Research Unit, University of Sussex

Organised by Energy Economics Group.

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Bright prospects for Canadian gas

By Judith Gurney

The Canadian natural gas industry, stimulated by higher prices, is expanding to meet increased demand in Canada and in the United States. The Canadian Gas Association forecasts a growth rate of sales within Canada of 2.5 percent a year, perhaps reaching 3 trillion cubic feet (tcf) by 1995. It expects most of this new demand to come from the industrial and power generation sectors in the Canadian West and Midwest. The industry also expects to be an increasingly important source of supply for its southern neighbour. US gas imports from Canada, historically mainly to California and the Midwest, have nearly tripled since 1986; in 1992 they accounted for 10 percent of total US gas consumption. Imports of Canadian gas are expected to grow well into the 1990s, with the Northeast market taking a larger share.



Reserves

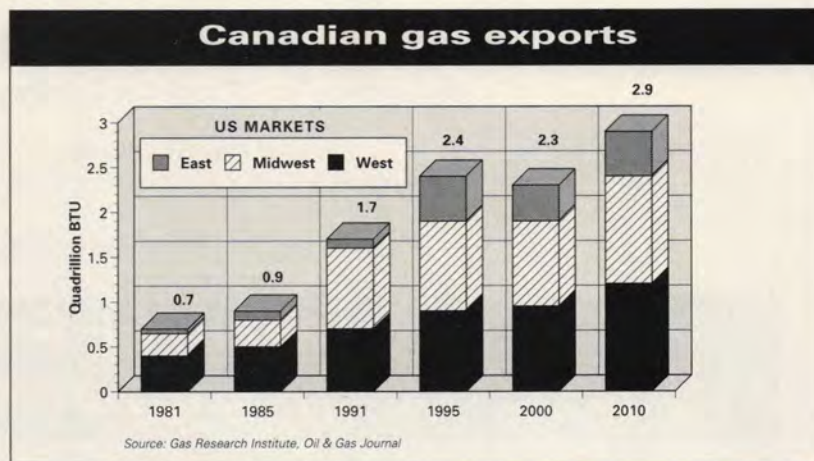
Canada had 98.4 trillion cubic feet (tcf) of established natural gas reserves at the end of 1992, of which some 85 percent – 83.2 tcf – were non-associated gas. Most of these reserves are in Western Canada. The province of Alberta has 57.6 tcf and adjacent British Columbia, 8.8 tcf. Some 16.8 tcf are scattered in Ontario, Saskatchewan, the Arctic Islands, the MacKenzie Delta, the Yukon Territory and the Northwest Territories. Approximately half of the total established reserves in the Western Canada basin are contained in Cretaceous rocks, more than one-quarter in Devonian rocks and the rest in Jurassic, Triassic and Permian-Carboniferous strata. Some reserves are sour gas which must be treated to prevent pipeline corrosion en route to distant markets. Research suggests that the volume of undiscovered gas reserves is considerable.

The Canadian gas industry is comprised of a mixture of large and small companies, with the latter banding together for shipment and

marketing. The small companies tend to be start-up businesses with only a few oil and gas properties located outside the Alberta heartland. Exploration has heated up as a result of industry optimism and this has led to a shortage of experienced rig drilling crews. Drilling in Western Canada in 1993 for both oil and gas is estimated to reach almost 7,000 wells, according to the Oil & Gas Journal, compared with only 4,654 wells in 1992.

Exports

Canadian exports of natural gas to the United States are expected to reach at least 2.25 tcf by 1995 and to be worth then about US\$4 billion. Subsequently, they are expected to rise to 2.9 tcf by the year 2010. This estimate is based largely on an analysis of US supply and demand for natural gas and on Canada's ability to deliver gas to key US markets.



The supply of US natural gas is diminishing and average US gas well production has declined from 500 million cubic feet a day (MMcf/d) in 1972, to 185 MMcf/d in 1992. Statistics from the US Energy Information Administration indicate that although US natural gas production is steady or increasing slightly, reaching 18.9 tcf in 1992, reserve replacement is declining. Gas reserves fell 1.2 percent in 1992, to 165 tcf, and the gas reserve life index declined to a 25-year low of 9.5 years. New discoveries contributed only 40 percent of production in 1992, compared with a 15-year average of 71 percent. The Clinton administration's championing of natural gas as a clean fuel whose use will reduce dependence on Middle East oil is expected to increase US demand for this fuel. Whether this will stimulate exploration that will, in turn, lead to increased proven reserves is under debate. At least in the short- to medium term, its effect is likely to mean increased importation of Canadian gas.

US markets

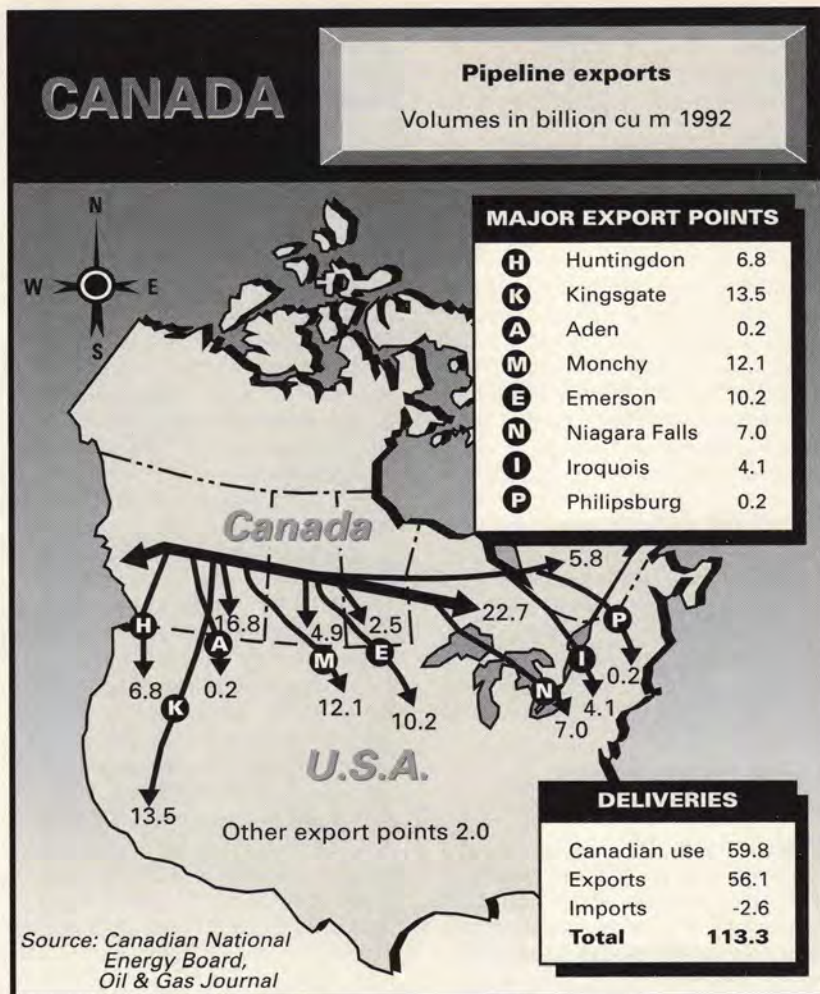
Canadian gas exports go to three different US markets. California is the traditional market but demand there is growing slowly and many consider that the state is oversupplied in terms of gas pipeline capacity. The adjacent Pacific Northwest, however, is considered to be a promising market, as its population is increasing at a rate of 3 to 5 percent a year and there is potential for gas sales to new power generators.

The Columbia River, the traditional electric power source for the region, has no capacity to support more hydroelectric plants, while there are environmental and safety concerns about new nuclear or coal-fired plants.

By contrast, the US Midwest is a stable, large-volume market. Canadian gas sold there, however, faces competition from US Panhandle production. The US Northeast, by contrast, is considered to hold much promise for Canadian gas. Lacking pipeline connections to US producers, the gas share of the energy market in the Northeast is currently the smallest of any region in the United States; the region is now being connected to Canadian pipelines.

Terms of sale

The sale of Canadian natural gas in



the United States, like that of domestically produced gas, is affected by Order 636 of the Federal Energy Regulation Commission (FERC) which took full effect on 1 November. This order requires the unbundling of services by pipeline companies and their reversion to common-carrier status. Customers can negotiate purchase terms with everyone involved in the fuel's production and transportation. Pipeline companies have been forced to cancel long-term contracts with suppliers as a result of being forced out of their regulated middle-man operations.

A restructuring of supply arrangements for Canadian gas exporters to California is currently being finalised. Pacific Gas & Electric (PG & E), a major California utility, has signed a preliminary accord to replace long-term agreements with shorter-term contracts with most of its Canadian natural gas suppliers. Alberta & Southern Gas of Calgary represents some 190 producers and has been involved in long-term discussions with PG & E over existing contracts, many of which were not scheduled to

expire until the year 2008. PG & E, in turn, has been under pressure from the regulatory California Public Utility Commission to open the Alberta-California pipeline system, which PG & E controls through its subsidiary Pacific Gas Transmission, to all users.

The memorandum of understanding that was signed in August involved 120 of the 190 members of the Alberta & Southern Gas Canadian supply pool and covered roughly 75 percent of the pool's volume of exports. PG & E reportedly offered suppliers \$200 million to tear up their existing contracts. The new contracts cover three season price periods: August-November, December-March and April-July. They offer each producer a contract on a pro rata basis tied to current sales volumes. More flexible arrangements include short-term sales between producers and end-users and brokered transactions. Producers have the option to sell gas to Alberta & Southern Gas, to sell to PG & E, or to sell directly to industrial buyers in California. Gas sales of

about \$1 (Canadian) billion a year are involved and it was hoped to complete the new arrangements by 1 November, the beginning of the heating season.

Other export contract restructuring has involved Western Gas Marketing, a Canadian supplier with 1.2 tcf annual sales, in its arrangements with three US pipeline companies. In addition, a subsidiary of TransCanada Pipelines has agreed to sell 159 Mmcf/d of Alberta natural gas directly to five Wisconsin local utilities instead of to the utilities' present pipeline supplier.

Changes in pipelines' contracts are also happening in Canada. Alberta gas producers recently refused new contract proposals by three major gas utilities in Ontario and Manitoba for the new heating season. Producers in the Alberta supply pool are seeking a pricing formula indexed monthly, probably to New York Mercantile Exchange gas futures. They are also trying to negotiate new contracts with gas distributors in Ontario and Quebec.

Pipelines

Expectations by Canadian gas producers of increased sales have led to a flurry of pipeline construction, both expansions of existing lines and new lines. As oil and electricity produced by hydropower are the main energy sources in the Canadian Atlantic provinces, there are no current plans to extend gas pipelines to the Canadian East Coast. Most new construction involves the export market.

TransCanada PipeLines, a major pipeline company of Calgary, has spent \$3.8 (Canadian) billion since 1989 expanding its pipeline system from Western Canada to markets in Central Canada and the US Northeast. Expansions last year by TransCanada, in conjunction with Northern Border Pipeline of Omaha, Nebraska, have added about 550 MMcf/d in capacity to northeastern US markets. TransCanada is operator and a partner in the Iroquois Gas Transmission System, which began shipping gas in 1992 into the US Northeast from TransCanada's mainline connection in Ontario. Iroquois, with a capacity of 607 MMcf/d, is currently seeking regulatory approval for an 85 MMcf/d expansion of its line to Long Island, New York. In addition, TransCanada and ANR Pipeline, a unit of Coastal Corporation of Houston, have proposed the construction of a 199-mile Mayflower Pipeline extension from the Iroquois system through southern Vermont to the Boston area.

Meanwhile, construction began last summer on the 155 mile Empire State Pipeline intended to deliver 270 MMcf/d to customers in western and central New York state. This will be connected to TransCanada's Blackhorse extension.

In projects directed at the US West Coast market, Pacific Gas Transmission Company, the PG & E subsidiary, has completed its \$1.92 (US) billion expansion of the pipeline system connecting Alberta producers to markets in California and the US Pacific Northwest. TransCanada has a conditional agreement with PG & E to purchase the Pacific Gas Transmission network in the near future. Some analysts feel that this expanded pipeline system, which will be able to move 900 Mmcf/d and thus increase the capacity of the import system by 75 percent, is overkill. It is hoped, however, that extensions beyond California will absorb any extra capacity. TransCanada and Sierra Pacific Resources Co, a Reno, Nevada energy holding company, have applied for permission to construct a pipeline from the Pacific Gas Transmission system to Reno, Nevada. This extension is intended to deliver, initially, 111 MMcf/day to residential and industrial customers in that area and its capacity could be doubled by adding compression. The two companies hope to begin construction in the spring of 1995 and to complete work by that autumn. They have formed a partnership, Tuscarora Gas Transmission Co, to build and operate the pipeline.

Pipeline projects to service the US Midwest market include a Northern Border 146-mile line across Iowa into the Chicago area. In addition, InterCoastal Pipe Line of Ontario, in conjunction with others, has applied to lay a 12-mile lateral to connect its existing line with underground storage and pipeline facilities in St. Clair County, Michigan. It also hopes to switch some of its pipeline systems inside Canada from carriers of crude oil to carriers of natural gas.

One export pipeline project, however, has been postponed. Altamont Gas Transmission Co, which consists of Tenneco Gas, Amoco Canada Petroleum and Montana Power, has put back until 1995 the completion of new line from Alberta to connect with Kern River Transmission system in Wyoming. This, when built, will serve market areas in Nevada, Utah, Colorado and New Mexico.

Recent applications for pipeline projects within Canada include

pipeline additions in Alberta, Saskatchewan & Manitoba by Interprovincial Pipe Line of Edmonton, and several small expansions of existing lines by Alberta Gas Transmission, Amoco Canada, Bow River Pipeline, Canadian Western Natural Gas and others. Foothills Pipelines (Yukon) has an application pending for the construction of a 1,429-mile line from Arctic coast near Inuvik, North West Territories, to central Alberta where it would connect with the existing North America system. There is also a Pacific Coast Energy Corp proposal for a 118-mile Vancouver Island pipeline project and a Polar Gas Ltd. proposal for a 1,450-mile line from the Mackenzie Delta to Alberta. A subsidiary of Hondo Oil & Gas of New Mexico has applied for permission to build a 746-mile pipeline to move gas from the Mackenzie Delta to Kenai, Alaska, for conversion to LNG and shipment to Pacific Rim markets.

Conclusion

The optimism of Canadian gas producers is of recent origin and reflects the 24 percent run-up in North American gas prices this year. Before this, it was a different story. Depressed prices until mid-1992 reduced producers' efforts to connect their shut-in gas and, as a result, marketers experienced deliverability problems during a cold snap during last winter. One company that suffered badly during the industry slump was Amoco, which acquired Dome Petroleum in 1988 for \$4 billion and became the largest natural gas producer in Canada. Dome's reserves, albeit large, are so widespread across frozen Western Canada that they proved unprofitable in this period. By mid-1993, Amoco had racked up losses of more than \$750 million from Dome operations and had come perilously close to defaulting on its takeover debt. Only after severe restructuring, including getting the parent company in Chicago to use its triple-A credit rating to guarantee the Canadian subsidiary's debt, was Dome finally able to climb into the black, aided by higher gas prices.

There is a limit, however, to the beneficial effects of gas price increases. With the current widespread fuel conversion potential of industrial and utility customers, gas demand will fall when gas prices exceed the price of oil - unless oil prices rise as well. ■

'Western oil and gas activity in the FSU has already taken off'

By Chris Johns, Senior Negotiator, Exploration and Production, British Gas

The Former Soviet Union (FSU) has been better endowed with energy resources than any other country in the world. It is the world's largest oil producer and possesses the largest oil reserves outside the Arabian Gulf region. It is estimated to have 6 percent of the world's proven oil reserves. In terms of gas, it has even greater riches, with about 40 percent of the world's total remaining proved reserves.

The main energy reserves of the FSU are contained in the vast sedimentary basins of West Siberia, Timan Pechora, the Caucasus, Central Asia, including Kazakhstan, and Sakhalin on the far eastern edge of the country. Many of these areas are remote, sparsely populated and subject to extreme, indeed hostile, environmental conditions.

The Russian oil industry has a long history. It was a major producer at the turn of the century, with around 30 percent of world petroleum exports. Stalin served his apprenticeship in 1901 as a revolutionary in the great oil centre of Baku.

As the more accessible reserves have been depleted, energy explorers have been forced to look beyond the European frontiers of the Ukraine and Volga Urals regions, into remoter parts of the country, thereby dramatically increasing the distance between them and the large, urban and industrial demand centres. The oil industry has been additionally burdened by an unrealistically low price for its product and a lack of hard currency which denied it access to modern technology and up-to-date equipment, materials and supplies. These factors contributed towards the dramatic decline in Soviet energy production we have witnessed during the late 1980s and 1990s.

The FSU is undergoing a metamorphosis. The region is being transformed in a way and at a speed which would not have been considered possible even a few years ago. New governments have assumed control of their indigenous energy resources and are determined to develop them to help rebuild their economies.

These are the combined, economic, social and technical factors which

have presented Western companies with a unique opportunity to invest in the renewal of the energy sector in the FSU. Many western companies have taken an interest.

A total of 143 ventures in the CIS and Republics are at various stages of development. The most popular region is that of West Siberia with 49 ventures, followed by Kazakhstan (20), Volga-Urals (17) and Timan-Pechora (14). What the numbers do not convey is the significance of each venture. For example, the Tengiz project ranks equal with a small workover project.

As those who work in the FSU know, it is very difficult to conclude a meeting without signing some form of Protocol which is usually worded to provide maximum impact and minimum commitment. However, by the time a Feasibility Study is in progress, the western side is putting in significant effort (and sometimes significant sums).

Once the JV (or JSC under RSFR legislation) is formed and contributions to the Charter Fund or Authorised Capital are being made, the project is usually active. A total of 77 Ventures are classified in the committed/investing and operating/producing categories. Again, the point of materiality of some of these ventures applies. However it does help to substantiate the argument that, contrary to generally held opinion, western oil & gas activity in the FSU has already taken off. The counter argument can be applied in the case of the so-called 'bellwether projects' like Tengiz, Sakhalin and other major projects, but projects are moving forward and gathering more and more attention within the FSU.

The growing contribution of JV's

which are currently active to future production levels is clear. This is very much a topical issue in a political sense. In June, the Ministry of Fuel & Energy unilaterally stopped JV exports, arguing that they were over-exporting compared with sanctioned levels. This may or may not be but the point is that JVs were increasing production against the overall trend which was strongly downwards. Total available export volumes are greater than export capacity and greater than government norms. The underlying issue is that Joint Ventures are competing for export capacity against the Producing Associations which have their own Export Quota. Intermingled is the huge financial incentive to divert oil destined for the local market onto the export market. Ultimately the problem should go away as the domestic price rises to international levels but it is ironic that the success of Joint Ventures in pushing up production levels is currently viewed with suspicion, if not outright hostility.

British Gas in the FSU

In building an international business presence, we have identified geographic areas of particular interest. These will often be areas where we feel there is considerable scope for BG to develop downstream interests at the same time as E&P opportunities. In fact, we at British Gas see the ability to offer both upstream and downstream expertise as giving us a particular competitive advantage.

But the major area with enormous potential for both upstream and downstream interests is the Former Soviet Union. Here there are considerable investment opportunities for

British Gas as an integrated company.

KomiArcticOil

In Russia, British Gas has a 25 percent interest in the KomiArcticOil Joint Venture which has been operating since December 1991. The other partners in the JV are Gulf Canada Resources who also have 25 percent, and the local Producing Association, Komineft, who have 50 percent. (Recently the local geologia - Ukhtaneftegeologia - have taken a 10 percent interest reducing Komineft to 40 percent.

The Joint Venture is involved in a project on the Arctic Circle in the Komi Republic, 1,500 km northeast of Moscow. The major activity is the appraisal and development of the Upper Vozev oilfield.

The first phase of the project involves the recovery of 100 million barrels of oil with gross capital expenditure of about \$200 million. Further phases are planned which will recover an estimated 400 million barrels.

Since December 1991, production from the Upper Vozev field has increased from 3,500 b/d to 14,200 b/d (1993 average). A total of 10 new production wells has been drilled and 20 existing wells are being worked over to improve productivity. The Russians have a lot of experience in working in Arctic conditions with very limited resources. Russian equipment and crews are used to drill the wells, with supervision provided by Gulf Canada and British Gas staff.

The Joint Venture is currently staffed by 216 Russians and 51 Western specialists working together to build what is, operationally, a distinct organisation. The Board of the Venture has three Directors nominated by each of the western partners and six from Komineft. There is complete intermixing of Russians and westerners within the organisation.

The very different backgrounds of the two sides, their differing approach to technical and commercial issues and the severe operational conditions faced in getting the Venture up and running have created significant challenges.

There is a sense in which the experience of building ventures like this is a micro version of the challenges faced by the Russian government in trying to stimulate a change of approach for the whole country.

Our experience, thus far, has been very positive and the Venture is working well despite some of the

hurdles it has had to overcome:

- **The transition from a Soviet planned economy to a market economy is creating day-to-day pressures in a number of areas.**
- **When the Joint Venture Charter was negotiated, the official rouble/dollar exchange rate was 1.74. Now, the so-called market rate is around 1,000+.** This creates problems for the valuation of the Russian input to the Joint Venture Fund.
- **In the same vein, the liberalisation of prices and the backlog of inter-company debt between Russian organisations is slowing down the availability of Russian sourced goods and services.**
- **It is also, almost a full-time job keeping up with the volume of new legislation in the form of laws, decrees and edicts.**
- **Because of the Russian government's desperate need for hard currency, the temptation to modify the fiscal regime applicable to hard currency-earning oil projects has been considerable.** Early in 1992 the government issued a decree imposing a ECU30 per tonne tariff on oil exported from Russia. This would have killed the economics of most JVs including our own. We lobbied hard with the government and were given a temporary exemption, subsequently extended to all JVs registered before 1 January 1992. However, recent events show that one cannot be certain that decisions are long-lasting. More recently we have been affected by the unilaterally imposed ban on exports by all joint ventures in June and by decree 715 which introduced new regulations regarding certification that oil being exported is actually oil produced as a direct result of investment by the joint venture.

Because of the gap between the internal Russian wholesale prices for oil and gas and the world market price, there will inevitably be points of stress until the gap closes. Despite the many frustrations we do find that the Russian authorities are willing to discuss problem issues and to respond when an effective case can be made.

Kazakhstan

British Gas also has developing

interests in Kazakhstan – a major republic of the FSU. Its land area is roughly equivalent to half that of Western Europe and it ranks second only to the Russian Federation in size. It stretches from the Caspian Sea in the west to China in the east. Its population of around 17 million people includes roughly 40 percent ethnic Kazakhs, 40 percent Slavs, with the remainder composed of a mix of other ethnic and national groups.

On 16 December 1991, Kazakhstan's National Parliament enacted a law declaring independence. Since then, President Nazerbaev has publicly endorsed economic reforms aimed at a rapid transformation to a market-based economy.

With a view to attracting foreign capital, a new foreign investment code was enacted. As a result, foreign investment is now permitted in any sphere of business activity, with the exception of manufacturing products for military purposes.

Consistent with this policy, on 28 February 1992, the government of Kazakhstan issued a document detailing the conditions of competition for a foreign partner for the continued development of the Karachaganak field.

Some time before the publication of this tender document, British Gas and Agip had joined forces. Both Agip and British Gas had identified Karachaganak as an investment opportunity; both also recognised the cost and complexity of the challenges associated with its full development. Due to the size and nature of the project, both companies were interested in finding a partner to:

- minimise commercial risk, and
- limit financial exposure.

Recognising the synergy that could be harnessed by merging the expertise both companies had in developing complex gas reservoirs, a Memorandum of Understanding was signed in the autumn of 1991. From that point, British Gas and Agip approached the Karachaganak Project as joint bidders.

Karachaganak lies on the northern edge of the pre-Caspian depression in north-western Kazakhstan. The field is partially developed and encompasses a surface area of 600 square kilometres. It is the largest gas field and the second largest oilfield in Kazakhstan.

Discovered in 1979, by July 1992 it was producing gas at the rate of slightly less than 8 million cubic

metres per day and condensate at just below 10,000 tonnes per day. All of this product is currently exported to Orenburg, just over the border in Russia, for processing and onward distribution.

Prior to our involvement, over 200 wells had been drilled of which 147 of these are development wells, 33 of which are producing, a further 10 are idling. Field works now in progress will assess how many of the remainder are capable of production, bearing in mind that capacity is presently constrained by both current facilities and financial resources.

Over the initial 40-year licence term, preliminary engineering estimates forecast production of 243 million tonnes of oil and condensate and more than 550 billion cubic metres of gas. This amount of gas is equal to the total gas demand of Britain for more than a decade.

We plan that production will peak in the first few years of the next century at an estimated rate of 10 million tonnes of liquids and 25 billion cubic metres of gas per year. This represents an increase over the current production figures of two and a half times for liquids and eight and a half times for gas. Our current development plan envisages recycling six billion cubic metres per year. Gas sales will therefore be correspondingly reduced.

Karachaganak risks

Participation in Karachaganak is not without technical or commercial risk. A number of factors come into play, many of which are beyond the control of either investor or government. Such components need to be considered in the overall commercial assessment of whether or not to proceed with the project.

Karachaganak is approximately 2,000 kms away from Western Europe, the most likely market for our product. Although both gas and liquid pipelines exist, the gas line transits both Russia and the Ukraine before reaching Uzhgorod on the Slovak border. More options are available for the transportation of liquids but distance and the inter-republic transportation issue remains.

There is uncertainty surrounding pipeline capacity. This is a matter attracting our attention and its resolution is necessary before we can complete our Final Agreement with the government.

Illustrations of more short-lived issues are the absence of locally

sourced, high technology oilfield supplies. Given a sensitive approach to local market conditions, British Gas and Agip have the opportunity to encourage the development of such industries by packaging work in such a way that local companies may form, competitively bid and win contracts.

There is also an element of fiscal uncertainty. The legislation currently enacted covers only the outlines of what we in the west regard as workable legislation.

Other fiscal risks include the absence of double taxation treaties and currency convertibility.

Positive factors

A number of factors weigh heavily in favour of investing in Kazakhstan. Firstly, the Karachaganak field is very large. Furthermore, enough well-control data exists to have eliminated the exploration risk. Up-to-date pressure and production data means that the risks normally associated with a development of a field of this size have been minimised. Further attractions are the partly developed and producing nature of the field, proximity of a transportation system and the presence of a skilled and experienced labour force.

Last, but by no means least, since the restructuring of the FSU began some two years ago, Kazakhstan has experienced no major social or political turbulence. President Nazerbaev is pursuing a policy of close links with Russia with an objective of maintaining the stable, multi-ethnic character of the country.

Next moves

Now I want to look at the steps we have to take before our participation in the project is confirmed. There are two forms of co-operation between energy investors and the state. Chevron, in the Tenghiz area, is in the process of agreeing Joint Ventures.

In our case, the government held a competition whose stated aim was to transfer the entire economic interest in the Karachaganak field to the winning applicants. Revenues to the government are expected to be in the form of an initial payment, followed by further payments in the form of taxes and production share.

Following the very successful bidding process, one of the first in the FSU to meet its published timetable, the government of Kazakhstan set a tight schedule leading up to the signing of the Final Agreement.

Once this Final Agreement becomes effective, British Gas and Agip are committed to an aggressive investment schedule. The vast majority of the expenditure will be on drilling and production facilities but a portion is dedicated to the enhancement of the social infrastructure.

However, before we reach this agreement, a number of other issues will have to be negotiated and resolved. These include:

- a full field development plan
- a full production sharing agreement
- an agreement covering the operation of field facilities
- contracts for the long-term sale and transportation of gas and liquids
- enactment of Kazakh legislation particularly the Petroleum Law, and
- a Double Taxation Treaty between the United Kingdom and Kazakhstan

By any standards the Kazakhs have set a demanding schedule which reflects their determination to attract and retain foreign investors to the Republic.

Progress with the Karachaganak project represents a substantial step in achieving British Gas' stated aim of creating a major international energy business. It symbolises the initiation of a long-term relationship amongst British Gas, Agip and the Republic of Kazakhstan for the mutual benefit of the companies, the country and its people.

Because of the dramatic and fundamental changes which have taken place within the Former Soviet Union since *perestroika* and *glasnost*, it is easy to overlook the fact that western companies have been doing business in what is now the FSU for many years. In fact, business ventures in Russia involving gas date all the way back to the 1860s.

I think that those of us investing in the FSU at this stage are aware of the risks as well as the rewards. Also that there is a lot of goodwill from the Soviet side to making these re-established business links work which I hope will be pursued with less ambiguity as a result of the recent political events in Moscow. ■

This article is based on a talk given to the IP Exploration and Production Discussion Group in October.

Development in microbial control in metalworking fluids

'Microbes are smarter, wiser and more energetic than microbiologists, chemists and engineers'

This much-quoted comment contains substantially more than a grain of truth – certainly sufficient to keep the topic of microbes in metal working fluids (MWF) permanently on the agenda of the IP Microbiology Committee. Not only are microbes clever enough to outsmart petroleum technologists but they seem to be encouraged in their dirty work by recent shifts in the regulatory situation, particularly where these restrict the availability and application of anti-microbial chemicals (biocides).

Biocides are toxic chemicals and are subject to increasing scrutiny and regulation; products containing high concentrations of biocides, such as system cleaners and metalworking fluid concentrates will be affected by the same regulations as biocides. At a time when killing microbes with biocides has received more regulatory attention, there has been increasing pressure from HSE and other authorities to more effectively suppress microbial growth in MWF. The IP symposium held on 14 October was timely and addressed these issues and attracted a large and interested audience.

The programme was brought firmly down to earth by the first speakers, Alan Evans and Kevin Reynolds, of Lucas Diesel Systems. The consequences of coolant breakdowns in modern integrated machine shops were highlighted and attention drawn to the high costs of disposal of spent coolant – £450 for a 4,000 gallon tanker. The plea for easier to clean machines has often been heard but this important consideration still eludes the attention of the machine tool builders and continues to frustrate the anti-microbial strategies of the MWF user. A complaint of the complexity, mystery and sometimes irrelevance enshrouded in Safety Data Sheets was voiced by the Lucas speakers and repeated later in the symposium.

Colin Townsley of Castrol International presented a stimulating paper on trends in MWF formulation and how they will impact on the potential for microbial spoilage. Much is now known on the 'biological hardness' of fluid components although there is always a trade-off against disposability. The more active anti-microbial measure is to incorporate preservatives/biocides into a MWF formulation but this must be done with due regard to the latest information on the health and safety aspects of biocide use.

HSE has become increasingly concerned about the potential health risk from microbes in MWF and has initiated research programmes to substantiate perceived mechanisms. Brian Cook presented the results of surveys

which related exposure to microbes in MWF to blood analysis and to clinical symptoms. A figure of 6 percent of staff could suffer from asthma or rhinitis following exposure to contaminated MWF aerosols. Mark Piney reviewed the control measures available for suppressing microbial growth and reducing exposure to fluids.

The scheduled speaker on Regulatory Issues withdrew at a late stage and Ted Hill, the current chairman of the IP Microbiology Committee, stepped in to summarise the impact of recent regulatory moves on the supply and use of MWF and associated products. Most delegates were probably aware of the 1993 UK CHIP regulations and their requirement for standardised labelling and the provision of Safety Data Sheets but the draft EC Biocidal Products Directive is also of some consequence as it will regulate the registration, supply and use of both biocides and products containing biocides. The financial implications of registration will be such that fewer biocides and biocide formulations will be available. This could also affect availability of system cleaners. The 1993 German TRGS 611 Regulations are aimed at minimising nitrosamine formation in MWF by stipulating acceptable amines and amine derivatives and banning nitrates and nitrosating agents. A variety of check measurements become mandatory. Supply of MWF products to Germany are affected herewith.

In this presentation hazard categories from the UK Notification Scheme for Offshore Chemicals were quoted and distributed. These categories were revised in 1989, virtually by a reversal of the numbered grades and have just been revised again into lettered hazard categories A to E (hazardous to non-hazardous).

Rolf Skold of Berol Nobel has practical experience of several emerging techniques for physically controlling microbial proliferation and he ably contrasted and compared microfiltration, microflotation and two-phase separations. The cost projections indicated that such procedures are now serious contenders as MWF purifiers.

The 'cradle to grave' concept for MWF was completed by the paper from Roger Key of Severn Trent Water. The legislative framework was reviewed, particularly the Environmental Protection Act 1990 and the Duty of Care regulations.

The whole meeting gave delegates much food for thought and stimulated lively discussion guided by the chairman Peter Oates. Hopefully the new regulations and increased awareness will contribute to a safer, greener environment, although the cost of this may be considerable. ■

Edward C Hill

IP WEEK 1994
Programme of Events

- February 14 2001 A Sulphur Odyssey: A Review of Likely Sweet Crude Supply and Premia - Conference. **IP contact: Susan Ashton**
- February 15 7th Oil Price Seminar - Price Formation around the World.
IP contact: Catherine Cosgrove
- February 15 Luncheon at The Dorchester Hotel, London. Guest Speaker: Mr Lee R Raymond, Chairman of the Board and Chief Executive, Exxon Corporation.
IP contact: Caroline Little
- February 16 Annual Dinner at Grosvenor House, London. **IP contact: Caroline Little**
- February 17 Upstream Atmospheric Emissions - Conference. **IP contact: Caroline Little**

Further information is available from the IP contact listed above.

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This document is available from the Institute of Petroleum at a price of £16.00. (Members £12.00) (Overseas £18.00) ISBN 0 85293 131 X

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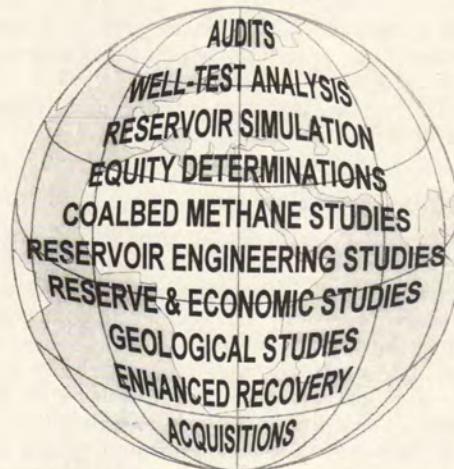
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Coriolis mass metering on LPG road vehicles

By F Kelly, Instrument Commercialisation Manager, Shell Research Ltd.

The three basic standards used for scientific and industrial measurement are time, length, and mass. Hydrocarbon flow measurements, however, are traditionally volume measurements, although the final result required is often the mass of product. This gives rise to a situation where volume is often incorrectly regarded as a primary measurement. Along the chain of production and distribution, the volume of a hydrocarbon will expand and contract with temperature and pressure, whereas the mass or energy content remains constant. Petroleum Measurement Tables are used to correct for these volume changes (to a standard volume – usually that at 15°C) and are typically applied at several different points in the chain, giving rise to a significant aggregate uncertainty in the final measurement.

The reason for this anomaly lies in the historic development of flow measurement devices. Most of these were developed to give outputs related to the volume of fluid passing through the meter, simply because that is a less difficult and, until recently, more accurate measurement than measuring mass directly. During the 1980s, the situation changed with the development of mass flow meters based on the Coriolis principle. In those ten years the Coriolis meter has gained a high degree of acceptance within industry and the achievable accuracies are now reaching the point where it can be seriously considered for measurements of custody transfer or fiscal transactions. This is reinforced by the fact that the IP and ISO are both producing guidance on standards for the use of Coriolis meters.

Operating principles

Each Coriolis meter manufacturer has a different configuration, chiefly to avoid infringement of patents but the operating principle is the same in all cases. A tubular metal structure is securely anchored at its fluid inlet and outlet connections and a vibrating motion applied at one or more points between the two anchors by an electromagnetic actuator. The driven points on the system are selected so that fluid travelling in a radial direction receives an angular oscillating momentum which in turn creates the oscillating Coriolis force. The structure is driven at its resonant frequency by a feedback system. Frequencies of the order of 75 to 100 Hz are typical (dependent on the fluid density and structural design) but higher harmonics of the fundamental frequency (800 Hz to 1000 Hz) can also be used.

The tubular structure is usually duplicated in a series or parallel arrangement so that the two sections cancel out any common mode vibrations. Sensors are fitted at two points on the structure to detect the Coriolis force

Two RFT 9712 units



Plate A Readout units for Coriolis meter mounted in cab of LPG truck

components, and theory shows the mass flow is directly proportional to the phase difference (or time interval) between the two sensor outputs. As mentioned above, the resonant frequency is a function of the fluid density, and a value for the latter (albeit less accurate than the mass flow measurement) can be derived.

Vibration amplitudes of the driven structure are typically around 2 mm and the Coriolis forces produce sensor movements around 25 micrometres maximum (equivalent to some 4 degrees of phase shift). Such small values mean that the design and performance of a Coriolis flowmeter is a compromise in the parameters of the tube and its construction (length, diameter, wall thickness, ease of manufacture and cost). To achieve maximum sensitivity, a long, narrow, thin-walled tube is required, but this results in a high pressure drop across the meter, and a low value for the static pressure rating.

The advantages claimed for Coriolis meters are their freedom from sensitivity to such fluid characteristics as asymmetric velocity profile, viscosity, temperature, density, pulsating flow and two-phase flow.

Disadvantages include cost, high pressure drop, size limit of some 150 mm, sensitivity to stress corrosion and sensitivity to environmental vibration.

LPG metering on road vehicles

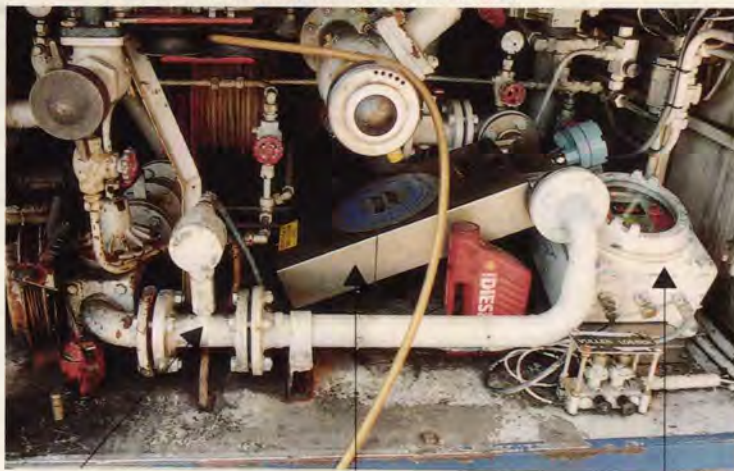
Road deliveries of LPG range from loads of 18 tonnes for industrial users, to less than one tonne for farms and hotels. At loading, the contents are measured on a weighbridge, and, in the case of large quantities, the entire load is delivered to the customer, using the weighbridge readings for invoicing purposes. For smaller quantities, the weighbridge is again used for loading but the multiple deliveries are then individually metered on the road vehicle by volume meter (positive displacement, or turbine), and converted to weight for invoicing purposes by using a theoretical value for the LPG density. Such a calculation routine will contain errors from both the measured volume, temperatures and the calculated density. In addition, wear in p.d. meters can be severe (amounting to several percent of reading between provings) because of the non-lubricious nature of LPG. In an ideal situation, these multiple deliveries would be metered directly by weight. The Coriolis meter would be a candidate to do this if it could provide the requisite accuracy, despite the high vibration environment in which it would have to operate.

The Rosemount Micro Motion meter was chosen for two reasons: a) that it was the first commercially available Coriolis meter and is now a fourth generation device, a mature technology with a considerable amount of experience designed into it, and b) that it performed well in trials conducted by the Dutch TNO authority at Pernis*, using propane. The Micro Motion meter is a balanced system using a pair of tubes mounted in parallel and resonated in anti-phase, to reduce sensitivity to flow noise and external vibrations.

Selection of field trial location

LPG loading terminals weigh the road vehicles before and after loading using weighbridges. These served as the reference standard of weight in the trials. The accuracy of weighbridges is frequently the subject of some debate but it can be out by up to 0.1 to 0.3 percent at worst. This is less than ideal, since the accuracies theoretically attainable with the Coriolis meter are of the same order, and the

Plate B Micro Motion D150 Coriolis meter mounted in series with existing VAF 2" turbine meter on BK Gas LPG truck



Turbine meter

Coriolis meter

Turbine meter readout

accuracy of the reference standard should be ideally an order of magnitude better than that of the meter. Consequently, precise volume measurements were to be a useful adjunct to this evaluation, since the Coriolis meter provides a volume reading, based on its own measurements of density and mass. Thus the accuracy of the latter can be inferred from a knowledge of the volume measurement accuracy.

Road vehicles delivering small bulk quantities of LPG use either p.d. or turbine meters. The former can be affected by significant amounts of wear between calibrations, owing to the poor lubricity of LPG. For this reason, the trials were carried out on a vehicle equipped with a turbine meter. BK Gas of Holland use 2" VAF turbine meters which are re-fitted with new bearings every 12 months. When these meters are re-calibrated against a reference meter every 12 months, the errors found fell within a standard deviation of ± 0.5 percent.

BK Gas were invited to co-operate in the trials, despite their geographical separation from Thornton Research Centre. In the event, the professionalism and enthusiasm shown by BK meant that the distances involved were never a problem.

Installation and methodology of trials

The BK Gas road fleet consists mainly of 50-tonne vehicles and one of these was fitted with a D150 Micro Motion meter in series with the turbine meter, as shown in Plate B. To reduce the vibration experienced by the Coriolis meter, the pipework immediately adjacent to the meter was fixed rigidly to the vehicle chassis and the base of the meter casing was supported by rubber mounting blocks. Readouts of weight and volume were provided by two Micro Motion RFT 9712 transmitter units, fitted in the driver's cab, on the passenger side, as shown in Plate A. (Later versions of the RFT 9712 will provide both weight and volume from the same unit and the unit will be certified to permit installation on the truck itself).

During the trials, the turbine meter, and the volume output of the Coriolis meter, were both calibrated every week against a master meter (a VAF 3" p.d. meter), which was itself calibrated every three months against a prover loop. Data were collected in the form of: 1) weighbridge tickets; 2) Coriolis readings of weight, volume, density, and temperature (W_c , V_c , D_c and T_c , respectively); 3) turbine meter readings of volume (V_t); and 4) pressure

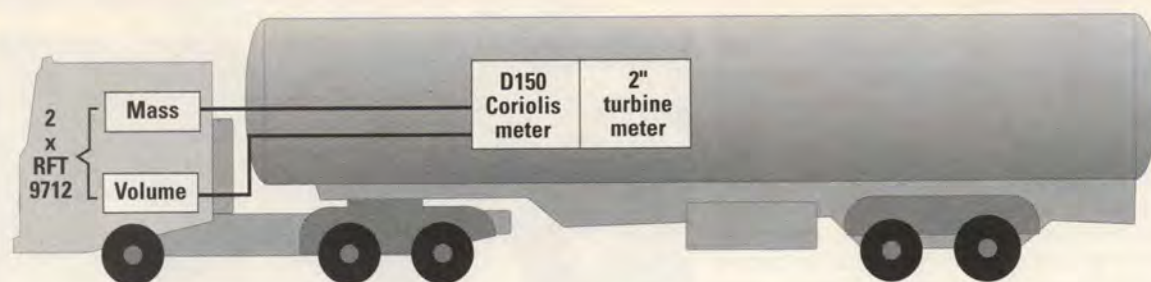


Figure 1 – Arrangement of meters and readouts for Coriolis meter on LPG truck

readings from the vehicle tank and delivery hose (Pt and Ph, respectively).

These readings were taken for each delivery, of which there were from 2 to 5 for each loading. The total of Wc readings from one loading could be compared with the appropriate gross and tare readings from the weighbridge for that loading. Values of Vt and Vc could also be compared. The test vehicle was filled with LPG at four different depots.

Results of trials

The trials ran continuously for eight months and, from a total of more than five hundred deliveries, the weight readings from the meter compared to the weighbridge values showed an apparent systematic error (x) of +0.45 percent and a standard deviation (s) of 0.65 percent compared to the turbine meter, the Coriolis volume readings gave values of $x = 0.33$ percent and $s = 0.19$ percent. There is a paradox here in that the Coriolis weight measurements seem to be less accurate than the Coriolis volume measurements, despite the fact that the latter are derived from the former! The explanation for this resides in the relative precision of the reference measurements used for weight and volume. As explained above, the reference for the weight readings was the weighbridge, which has an inferior precision to that of the turbine meter used as the reference for the volume measurements. In addition, loadings were done on different weighbridges, which would further degrade the achievable accuracy of the weight reference. In reality, the accuracy of the weight readings from the Coriolis meter must be at least as good as that of the volume readings from it.

The key parameter in trials such as these is the standard deviation of the results, rather than the systematic error. Whereas the latter is related to the calibration procedure (and as such can be removed by re-calibration), the standard deviation is a fundamental limitation of the meter performance, and determines its repeatability. The value of $s = 0.19$ percent for the volume readings indicates that the repeatability of the weight readings is better than 0.38 percent (95 percent confidence).

No problems resulted as a consequence of the high-vibration environment to which the Coriolis meter was subjected on the truck. This is an important finding, since Coriolis meters have traditionally been regarded as suspect in such situations.

One other aspect of the Coriolis meter performance is worth noting, namely the pressure drop across it. The flow rates normally achieved on the BK tankers are 700 litres/minute. With a Coriolis meter installed, the increased pressure drop reduced the flow to 600 litres/minute with correspondingly longer delivery times. The BK operation, using turbine meters with a pressure

drop of only 0.2 bar, is more sensitive to this pressure loss than is the case when p.d. meters are used, since the latter have a pressure drop of around 1 bar and a consequently lower flow rate of 400 litres per minute.

Conclusions

1. The trials ran continuously for a period of eight months. The high vibration environment to which the meter was subjected did not cause any problems over this period.
2. From over 500 deliveries, the Micro Motion meter weight readings apparently showed a systematic error $x = +0.45$ percent and a standard deviation $s = 0.65$ percent while the volume readings gave $x = 0.33$ percent and $s = 0.19$ percent. The paradox of the volume readings being more accurate than the weight readings from which they are derived is explained by the fact that the weight reference (multiple weighbridges) has an inferior precision to that of the turbine meter used as a reference for the volume readings. The Coriolis volume readings are thus a truer guide to the meter performance.
3. The true repeatability of the weight measurements by the Micro Motion meter is better than 0.38 percent (95 percent confidence).
4. The significance of these results for BK Gas is different to that for distributors using p.d. meters. The latter would clearly benefit from the significantly greater accuracy and minimal maintenance requirements of the Micro Motion meter, in comparison to their existing p.d. meters. On the debit side, there is a cost penalty, in that the Micro Motion meter is roughly twice the price of a p.d. meter (£8,500 compared with £4,000).

The situation with BK Gas is less clear-cut, due to the good performance of the existing turbine meters. At present there is no good reason for BK to change their metering system. However, there is a distinct possibility that the Dutch Weights and Measures authority will specify the installation of double pulse electronics on turbine meters within five years. This would be a significant cost and the Micro Motion meter would then have to be given serious consideration.

Reference

* Thj. Dingenouts. 'Investigation of the performance of a Micro Motion Model DS 150S mass flowmeter with propane.' TNO report 516216-90-3

Acknowledgement

The author wishes to thank BK Gas, and Dirk Kniepstra in particular, for their cooperation and advice, which made the success of these trials possible. ■

2001 - A SULPHUR ODYSSEY

A Review of Likely Sweet Crude Supply and Premia

14 February 1994

To be held at the Institute of Petroleum, London

Forecasts show that the global average sulphur level of crudes is likely to increase significantly in the future. At the same time, legislation is continuing to force down sulphur levels in a wide range of products. This pressure is growing both across the barrel and geographically, reducing opportunities for the absorption of sulphur in less regulated products or markets and making sulphur removal unavoidable. Unlike investment in conversion capacity, which is justified by higher revenue assumptions, desulphurisation investment is primarily driven by cost avoidance – the premium paid for low sulphur crudes. In view of the scale of investment which the refining industry faces, an understanding of the increasingly complex dynamics which determine crude sulphur differentials is needed. It is this issue which the conference will endeavour to address.

The following papers will be presented:

- Current Application and Valuation of Sweet Crudes
- Potential Changes in Sulphur Limits on All Products
- The Options and Costs of Desulphurisation within Refineries Implications for Premia
- Future Worldwide Supply of Sweet Crudes from Proven Reserves
- The Outlook for New Discoveries of Sweet Crude
- Forecast Demand and Price for Sweet Crude

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Finnish energy switch gathers speed



By John Cranfield

For 45 years from the end of World War II, Finland acted as a channel for the Soviet Union's energy trade. That all changed with the demise of communism and Finland's energy pattern is likewise set for a major switch in emphasis. Until recently, most of the country's oil and all of its gas flowed westwards from the USSR, with bartered capital goods going the other way. Much of the oil was destined for onward sale but all the gas was used locally, helping Finland to grow beyond the resources of its indigenous supplies of hydropower, peat and timber. Nuclear power has played a useful role in recent years but attitudes have changed. As a result, Finland is now looking west for its energy supplies. State oil firm Neste is becoming far more international and is today an active upstream player, a totally new role for the company.





Photo courtesy of Neste Production Limited

Last year, among Finland's 'conventional' energy balance, oil made up 48.2 percent. Gas provided 11.6 percent, coal 12.5 percent, nuclear 21.7 percent and hydropower 6 percent. But that is only part of the story. 'Non-conventional' energy sources added hugely to that, with over 1 million tonnes/year oil equivalent (t/yoe) of peat, 1.5 million t/yoe imported electricity and over 4 million t/yoe of other sources, mostly timber waste. All told, around 28 percent of the country's energy needs are met from indigenous sources. Coal use is slipping back sharply, oil is declining a little but gas is growing. Dependence on Russian energy is still high and may, in the short term, become higher. For parliament decided in September to drop plans for a fifth nuclear plant.

The figures above hide a remarkable transition in energy use over the past two decades. Oil, 20 years ago, provided over 50 percent of all energy needs. Today it supplies around 30 percent. And as the USSR broke up and was replaced by a Russia committed to hard-currency dealings rather than barter, the

proportion of imports from that source has steadily dropped to under 60 percent from over 90 percent. That trend continues. Neste has a target under which it would obtain some 3 million t/y of its oil needs, which total around 10 million t/y, from its own directly-owned sources. Buying Arco's Norwegian North Sea interests and Sovereign's UK assets will go a long way towards that. Elsewhere, Neste has taken small stakes in exploration ventures in Tunisia, Angola and a number of other countries.

Boosting gas

On the gas side, there is little immediate prospect of diversification away

from Russia. All current supplies, running at some 2.8 billion cubic metres/year (bcmy), flow from the Russian border north of St. Petersburg, along the south coast to



Natural gas from Russia comes over the border to Finland in a small village in the south-east, near the city of Imatra.



Laying gas pipelines into Finland involves coping with severe North European winters. That, and the relatively small market, have combined to undermine the economics of supply from the Norwegian Sea.

Helsinki and beyond. For years, plans have been floated to get a Nordic gas system going. Based on supplies from the Norwegian Sea, this would involve a pipeline across Norway and Sweden into Finland. But all plans have foundered because of Swedish uncertainty. Then talks began in the mid-1980s on a scheme to extend Finland's grid further west and across the Gulf of Bothnia. This would have allowed Soviet gas access to the potentially-large Stockholm market. At the same time, plans were kicked off for Norwegian Heidrun gas to be piped to Stockholm, with a trans-Bothnian Gulf link to supply Finland.

Separately, Neste has signed up with the USSR to double gas imports by 1995, when 4.5 bcm/y would be taken. This would allow the Finns to extend their grid to the west coast under a separate plan, put up by the USSR but not yet firmed up, a second import line would enter Finland from the north, allowing gas to be introduced to that region as well.

The Nordic plan envisaged a supply, of 1.5-2.5 bcm/y, flowing eastwards to Finland by 1995-6. That, although agreed upon in 1990, died at the end of 1991 when Norway claimed that the total volume, which included 2.5 bcm/y for Stockholm, simply would not be economic for the length of line required. However, in May 1992, Norway and Finland

resumed talks, with 4 bcm/y being mooted for Finland alone. If total throughput of 6 bcm/y could be achieved, Norway reckoned the line would be economically viable. Then, in March this year, the Swedes seemingly had another change of mind. With nuclear power now out of favour both in Finland and Sweden, the Norwegian gas option has come to the fore again. But a firm decision is a way off still. Also seemingly dead in the water is a 1991 Neste/Imatrans plan to import 1.5 bcm/y of Algerian liquefied natural

gas to Finland for use as power-station fuel.

Having been thrown back, for the time being, onto Russian gas supply, Finland is now boosting its grid to cope with the planned doubling of flow. The Rääkkölä booster station has been upgraded by the addition of a third 10MW compressor, which came into use in October, at a cost of \$20 million. Now the Severnaja booster station in Russia, on the Finnish import line north of St. Petersburg, is getting similar treatment. Due for early 1995 startup, this will be the first fruit of a joint-venture deal between Neste and Russia's Gazprom.

Clean-fuel emphasis

With a massive percentage of its economic well-being dependent on forest industries, Finland is keener than most on a healthy environment. To that end it has taken a lead in the production of unleaded gasoline, and low-sulphur diesel and fuel oil. That in turn has meant a sizeable investment in refinery modernisation. At Porvoo, a \$169 million project was kicked off in September to boost methyl tertiary butyl ether (MTBE) output and recover additional benzene. At Espoo, 100,000 t/y of benzene will be removed from gasoline in a new \$6-million plant, due to start up as Petroleum Review goes to press. And over \$50 million has been spent on additional sulphur-recovery plants at both Porvoo and Naantali refineries. These projects follow earlier schemes to maximise the production of environmentally-friendlier fuels. ■



Imatra hydroelectric scheme, in south-east Finland. Built in 1929, it has a hydroelectric capacity of 168MW. Photo courtesy of Geoff Sims

FORTHCOMING EVENTS

December

5th-10th

Moreton-in-Marsh: 'Handling of Emergencies in the Petroleum Industry'. Details: Rose Warwick, Course Bookings Manager, The Fire Service College, Moreton-in-Marsh, Gloucestershire GL56 0RH. Tel: (0608) 52196. Fax: (0608) 51788.

6th

London: 'Environmental Economics'. Details: Liz Kinniment, IBC Technical Services Ltd., Gilmoora House, 57-61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383. Fax: (071) 631 3214.

6th-7th

London: 'Port State Control - New Solution or New Problem?'. Details: Athina Peters, IBC Legal Studies and Services Limited, Gilmoora House, 57-61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383. Fax: (071) 631 3214.

6th-7th

London: 'The 8th International Energy Conference - Emerging Structures in Energy Industries'. Details: The Energy Conference, The Conference Dept., Chatham House, 10 St James's Square, London SW1Y 4LE. Tel: (071) 957 5700. Fax: (071) 957 5710.

6th-7th

London: '3rd Annual UK & European Gas Price, Supply and Demand Conference'. Details: Monique Quant, IBC Financial Focus Ltd., 57/61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383. Fax: (071) 323 4298.

6th-9th

Cranfield, Bedford: 'Electromagnetic and Ultrasonic Flowmeters'. Details: Short Course Administrator, Department of Fluid Engineering & Instrumentation, School of Mechanical Engineering, Cranfield Institute of Technology, Bedford MK43 0AL. Tel: (0234) 754766. Fax: (0234) 750728.

6th-9th

Shanghai, China: 'Shanghai Offshore (Oil & Gas) Expo 93'. Details: CP Ltd., Rm. 2801, Tung Wai Commercial Bldg., 109 Gloucester Road, Wanchai, Hong Kong. Tel: (852) 511 7427. Fax: (852) 5119692.

7th-8th

Cairo, Egypt: 'The Sixth Symposium of The Japanese Institute of Middle Eastern Economies (JIME) - The Middle East After the Storm'. Details: JIME, 9 El Kamel Mohamed St., Flat No.4, Zamalek, Cairo, Egypt. Tel: 20-2-3413752. Fax: 20-2-3415433.

7th-8th

London: 'Structural Analysis for Offshore Engineers'. Details: BPP Technical Services Ltd., 2 Tavistock Place, London WC1H 9RA. Tel: (071) 837 6362. Fax: (071) 837 0822.

7th-8th

Aberdeen: 'The Practicalities of Successful Partnering & Closer Working Relationships'. Details: The Customer Services Manager, IIR Ltd., Industrial Division, 28th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD. Tel: (071) 412 0141. Fax: (071) 412 0145.

8th

London: 'Recent Legal Decisions of Relevance to

Pipelines'. Details: The Pipeline Industries Guild, 14/15 Belgrave Square, London SW1X 8PS. Tel: (071) 235 7938.

8th-10th

Cumbria, UK: 'Advances in Water and Effluent Treatment'. Details: Mrs. Kristine Stones (Kit), BHR Group Limited, Cranfield, Bedford, MK43 OAJ, UK. Tel: (0234) 750422. Fax: (0234) 750074.

9th

London: 'Development and Application of New Materials Offshore'. Details: Society for Underwater Technology, 76 Mark Lane, London, EC3R 7JN. Tel: (071) 481 0750. Fax: (071) 481 4001.

9th

London: 'Alternative Dispute Resolution for the Oil and Tanker Industries'. Details: Jo Eason / Tim Waters, Asdem Ltd. Tel: (071) 493 0973. Fax: (071) 499 5270.

9th-10th

Paris: '1973-1993 Energy: Signals for the Future'. Details: Madame Sonia Weisbecker, Treasure Tours International, 15, rue de l'Arcade - 75008 Paris, France. Tel: 33-1 42 65 05 69. Fax: 33-1 42 66 04 47.

9th-10th

London: 'Floating Production Systems - 8th International Conference'. Details: Sarah Peace, IBC Technical Services Ltd., Gilmoora House, 57-61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383. Fax: (071) 631 3214.

9th-10th

London: 'Forecourt Retailing - European

Conference and Exhibition'. Details: Edward Bradfield, WEFA Ltd., 60-62 Margaret Street, London W1N 7FJ. Tel: (071) 631 0757. Fax: (071) 631 0754.

10th-12th

Moreton-in-Marsh: 'Senior Executives Weekend Fire Safety Management Seminar'. Details: Rose Warwick, Course Bookings Manager, The Fire Service College, Moreton-in-Marsh, Gloucestershire GL56 0RH. Tel: (0608) 52196. Fax: (0608) 51788.

13th

Aberdeen: 'BP Upgrading Forties Pipeline System'. Details: The Pipeline Industries Guild, 14/15 Belgrave Square, London SW1X 8PS. Tel: (071) 235 7938.

13th-14th

Vienna: 'The Outlook for Natural Gas in the 1990's and Beyond'. Details: Financial Times Conference Organisation, 102-108 Clerkenwell Road, London EC1M 5SA. Tel: (071) 814 9770. Fax: (071) 873 3975/3969.


13th-15th

Moreton-in-Marsh: 'Merchant Navy Ratings (Firefighting) Course' (plus one day optional Sea Survival Course. Details: Rose Warwick, Course Bookings Manager, The Fire Service College, Moreton-in-Marsh, Gloucestershire GL56 0RH. Tel: (0608) 52196. Fax: (0608) 51788.

14th

London: 'Reception of Hyperbaric Evacuations and Other Hyperbaric Emergencies'. Details: The Editorial Assistant, The Institute of Marine Engineers, 76 Mark Lane,





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14th

Cleveland: 'Addressing Environmental Problems in the Downstream Oil Industry Sector'. Details: Petroleum Training Association, Suite 1, Morley House, 314 Regent Street, London W1R 5AB. Tel: (071) 255 2335. Fax: (071) 255 1828.

14th

Preston: 'Biological Removal of Toxic Metals'. Details: Society of Chemical Industry, Conference Secretariat, 14/15 Belgrave Square, London SW1X 8PS. Tel: (071) 235 3681. Fax: (071) 823 1698.

14th

Paris: 'Natural Gas in the United States: The Politics and Economics of the "Gas Bubbles"'. Details: C.G.E.M.P. -Université Paris Dauphine, Place du Maréchal de Lattre de Tassigny, 75775 Paris Cédex 16. Tel: (33-1) 44 05 44 85. Fax: (33-1) 44 05 44 84.

15th-16th

London: 'Strategy & Economics in the North Sea Oil & Gas Industry'. Details: The Customer Services Manager, IIR Ltd., Industrial Division, 28th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD. Tel: (071) 412 0141. Fax: (071) 412 0145.

15th-16th

Moreton-in-Marsh: 'Sea Survival Course'. Details: Rose Warwick, Course Bookings Manager, The Fire Service College, Moreton-in-Marsh, Gloucestershire GL56 0RH. Tel: (0608) 52196. Fax: (0608) 51788.

January

11th

London: 'Deep Water Pipelaying'. Details: The Editorial Assistant, The Institute of Marine Engineers, 76 Mark Lane, London EC3R 7JN. Tel: (071) 481 8493. Fax: (071) 488 1854.

11-13th

Osfildern, Germany: 'Ecological and Economical Aspects of Tribology'. Details: Technische Akademie Esslingen, Postfach 12 65, D-73748 Ostfildern, Federal Republic of Germany. Tel: (0711) 3 4008-23,-24,-25. Fax: (0711) 3 4008-23,-24,-25.

12th

Leatherhead, UK: 'Restoration of Land Following Pipeline Installation' Details: The Pipeline Industries Guild, 14/15 Belgrave Square, London SW1X 8PS. Tel: (071) 235 7938.

12th

Derbyshire, UK: 'Trenchless Technology-Education and Training' Details: The Pipeline Industries Guild, 14/15 Belgrave Square, London SW1X 8PS. Tel: (071) 235 7938.

13-14th

London: 'Cost, Competition and Regulation in Power Generation and Supply' Details: IIR Ltd, 28th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD. Tel: (071) 412 0141. Fax: (071) 412 0145.

15-16th

London: 'Strategy and Economics in the North Sea Oil and Gas Industry' Details: IIR Ltd, Industrial Division, 28th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD.

Tel: (071) 412 0141.
Fax: (071) 412 0145.

16-18th

Bahrain: 'The Second Annual Middle East Petroleum and Gas Conference' Details: IBC Conferences, 545 Orchard Road, #12-01, Singapore 0923. Tel: 65+732-1970. Fax: 65+733-5087.

18-20th

San Antonio, Texas: 'Fourth Fossil Plant Inspections Conference' Details: Lori Adams, Conference Coordinator, Electric Power Research Institute, P.O. Box 10412, Palo Alto, CA 94303. Tel: (415) 855 8763. Fax: (415) 855 2041.

19th

London: 'Safety Analysis and Techniques Required for the Shipping Industry' Details: The Institute of Marine Engineers, The Memorial Building, 76 Mark Lane, London EC3R 7JN. Tel: (071) 481 8493. Fax: (071) 488 1854.

19-20th

Aberdeen: 'Improving Efficiency and Reducing Operating Costs Through Cost-Effective Offshore Maintenance' Details: IIR Ltd, Industrial Division, 28th Floor, Centre Point, 103 New Oxford Street, London WC1A 1DD. Tel: (071) 412 0141. Fax: (071) 412 0145.

21st

London: 'The New Gas Market: Competitive Opportunities and Challenges' Details: Brenda Ribero, The Economist Conferences, 40 Duke Street, London W1A 1DW. Tel: (071) 830 1093. Fax: (071) 931 0228

24-25th

London: 'Coalbed Methane

Extraction' Details: IBC Technical Services Ltd, Gilmoora House, 57-61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383. Fax: (071) 631 3214.

24-25th

London: 'Contaminated Land: Policy, Risk Management and Technology' Details: Amanda Wright, IBC Technical Services Ltd, Gilmoora House, 57-61 Mortimer Street, London W1N 7TD. Tel: (071) 637 4383. Fax: (071) 631 3214.

25th

London: 'General Simulation of Power Systems on Offshore Platforms' Details: The Institute of Marine Engineers, The Memorial Building, 76 Mark Lane, London EC3R 7JN. Tel: (071) 481 8493. Fax: (071) 488 1854.

25-27th

Malta: 'The Mediterranean Oil and Gas Exhibition and Conference' Details: Spearhead Exhibitions Ltd, Rowe House, 55-59 Fife Road, Kingston upon Thames, Surrey KT1 1TA. Tel: (081) 549 5831. Fax: (081) 541 5657.

26-27th

Aberdeen: 'Oil Spill Prevention and Coordinated Responses' Details: BICS International, First Floor, Chandos House, 12-14 Berry Street, London EC1V 0AQ. Tel: (071) 490 2076. Fax: (071) 336 7795.

27th

London: 'Building on Proven Strategies to Optimise Your Trade Marketing' Details: BICS International, First Floor, Chandos House, 12-14 Berry Street, London EC1V 0AQ. Tel: (071) 490 2076. Fax: (071) 336 7795.

Improved profitability via oil product inventory control

By M P Hyslop, Sales Director, Whessoe Varec Ltd

Oil product inventory control is concerned with monitoring product from reservoir to end-user. The responsibility for measurement falls, broadly, within three different sectors of the business – exploration and production, refining and marketing. As product moves through each of these distinct areas, the need for inventory control accuracy increases.

In each area there has been a tendency to improve, by technological means, the standards of accuracy that prevail. This can be seen in the improvement of 3D mapping techniques for oil reservoirs and the consequent improvement in provable reserve statistics; the various new developments in refinery loss control procedures; and the highly accurate measuring devices required for custody transfer and high value product in the marketing sector. Such control is vital to improving profitability in the oil industry.

These developments have often progressed on an ad hoc basis as particular parts of the business have, independently, striven to improve accuracy of measurement in a response to a need to reduce costs and improve profitability. In the oil business today such improvements need to walk hand in hand with concern for safety and the environment. They also need to be balanced by attention to the risk and crisis management issues which arise as a direct consequence of 'downsizing' and 'automation'. This last issue should not, but probably will, arise in the form of a disaster sooner rather than later.

Integration essential

Oil product inventory control should be viewed as a required integrated system of management for all companies. Such an integrated system is important to contribute fully to the reduction of costs and the increase in profitability needed by the industry; to the issues of environment, safety, crisis and risk management which are the constant

shadows of oil development; and to the changing, political, economic and social structures seen by global businesses such as the oil corporations. It would also bring an end to the fragmented problem solving of inventory problems in different parts of the business.

This article is therefore concerned with describing in general terms a direction to reduce costs and improve profitability in the oil industry by an integrated approach to inventory control. A comparison is made with some of the developments in the retail food industry and suggestions made on how to approach the problem practically.

Evolution and revolution

The retail food industry, and many other retail chains, have seen a number of evolutions and revolutions. The best known evolution is probably the trend towards larger and larger stores. The best known revolution is the introduction of Electronic Point of Sale (EPOS) technology – the use of bar codes to identify, price, re-stock and re-order items sold. The scale of

the revolution caused by EPOS technology has not had a visual public impact. However, by reading bar codes at the point of sale, it is possible to control the input to the supply chain by the purchased output, pure market-driven. Such a revolution has caused a massive reduction in stocking costs and transportation costs. This has an immediate impact on inventory costs and cash flow, thereby generating impressive improvements in profitability. Improved profitability is what most business is all about. So successful is the process that in some cases it is cost-effective to put bar codes on items where the bar code actually costs more than the item itself. (Some woods in DIY stores and some fruits are examples).

Prior to this revolution various attempts had been made to streamline the distribution network. This involved such methods as each retail chain developing particular distribution strategies, combining distribution methods and packaging for efficient transport (These have since been mirrored in the transport and distribution industry generally).

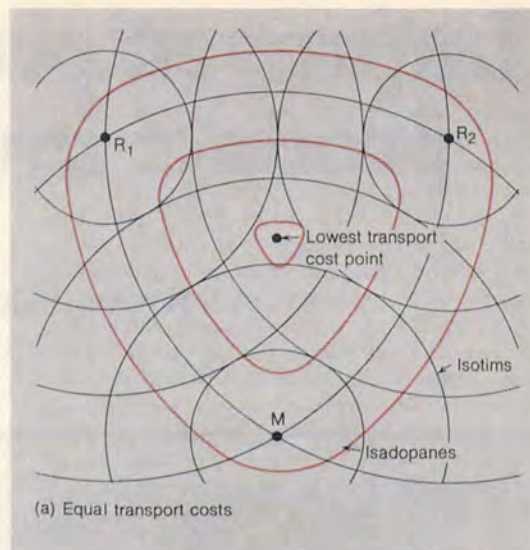
If this is compared with the situation existing in the oil business, then a number of similarities are seen with the retail industry before the bar code revolution. Costs vary proportionately with distance; producers are combining resources to cut costs and improve efficiency; investment is being made in controlling inventory because the value of losses and inaccuracies is sufficiently high to justify the cost and obtain a pay back: even if this is just applied to manpower. Bits of an overall system exist but few have yet addressed the overall problem.

The drive for inventory control in the retail food industry was forced by a need to cut costs, cut overall inventory and increase added value in the distribution system in response to a viciously competitive market and the need to maintain profits. The need to do something about the overall cost structure in the oil business is demonstrated by the influence of the UK retail food chains, e.g. Tesco, Sainsbury, Asda, in petrol retailing at superstores and the manner in which they have been able to take advantage of market conditions with proven techniques to carve, permanently, a slice of the market for themselves. Twenty years ago such a move would have been doomed to failure. Now such operators have a massive 20 percent market share and are building the infrastructure to challenge the traditional marketing structures in the oil business. A model, and the impact on profits, of an integrated control system is there for all to see. It is, of course, dangerous to draw too many comparisons because, for

example, few food retailers operate across the range of integrated activities that modern oil companies do. However, it is precisely because of this range that integrated control systems can bring greater benefits: and then the comparison becomes restricting.

Similar developments have been seen in the transportation and distribution industry generally. The CBI for example has described Just In Time (JIT) delivery systems as 'working best when it involves the distribution of a limited number of products. It is very difficult to operate a successful JIT system where thousands of different products are being shipped. However, the more industries standardise products, as the automotive industry, for example, is now doing, the more feasible it is to maintain a JIT approach to distribution strategy. Fundamentally, it comes down to a question of gearing manufacturing and distribution to market needs as opposed to production requirements.' In the same industry a drive is being made to rationalise the number of suppliers. A small number of suppliers already exist within the oil industry.

Within the exploration and production sector of the oil industry, great strides have been made in the identification, sizing and recovery of reservoirs. This has been achieved by



(a) Equal transport costs
Weberian structure

advanced seismic survey, 3D mapping, and horizontal drilling techniques. Nevertheless it is still not fully possible to accurately measure inventory in reservoirs. This will become an increasingly important area in the future. It is therefore at the delivery point of crude from production facilities that inventory control really begins.

Not only is the distribution of product classically Weberian in structure from a marketing viewpoint but it is increasingly so from a production point of view. The use of shared pipelines requires the reconciliation of stock as product arrives at collection points. Such is the importance of this reconciliation that good programmes have short payback periods.

Transportation of product to and from the refinery is a key area as both the Valdez and Braer disasters have confirmed. The delivery of crude by sea is especially important in terms of both quality and quantity.

Loss within the refinery has also developed into a key issue. This is both as a result of environmental legislation, potential environmental legislation and the drive to get ever more valuable, normally lighter, products out of modern crackers. The control of loss in refineries is the second most important aspect of inventory control in today's market.

Need for ultra accuracy

It is, however, within the marketing area that the greatest demand for accuracy has occurred. This is principally because of the demands of custody transfer and tax; as well as



The supermarket chains have 20 percent of the market

the high added value once the product leaves the refinery and the generally high value in pure money terms of relatively small quantities of product.

Taking the marketing area as an example, an historical development process can be seen. Measurement boards linked to primitive float gauges were the start of control in this area. Early devices merely indicated the potential for over-spill, or were a simple high alarm. In the United States, where Mogas products have been historically cheap and environmental controls lax, such devices remain common and are still produced in large quantities. In Europe the trend has been towards more sophisticated systems at a faster pace. This is because such storage sites became the sites of tax assessments, value addition and custody transfer. In the Far East the pace of growth will dictate a further need for accurate measurement. A wide variety of measurement systems have become available. These became so sophisticated that in time the accuracy of measurement devices exceeded the structural integrity limits of a tank as defined by strapping tables inputted, in some cases, over 30 years ago. In one classic case an inventory control company tried for months to discover why levels jumped up to several cm at particular tank levels: it was eventually found that once a certain weight was reached, the tank physically dropped by that amount.

The accuracy requirements became further defined by the ever increasing value in money terms of the stored product. A variation of 1mm in level may now mean the difference of several thousand dollars in large tanks of high value. More recently, the demand of environmental legislation has had an impact. In Europe today it is possible to measure product in tanks to an accuracy which takes account of tank structure changes induced by thermal changes, allows for and measures water bottom, temperature, level, density, and vapour as well as providing a continuous check for leaks. Such instruments have noted that tanks have temperature and density profiles which frequently defy accepted norms and thus open debates on how custody transfer can best be effected.

To understand the scale of

accuracy now involved, it is useful to recall the dioxin scare in milk. The debate only occurred because it became possible to measure the equivalent of a teaspoonful of dioxin in an Olympic swimming pool; much less than existing background levels. The accuracy of tank measurement devices approach an equivalent scale in certain instances. As with the milk debate, it is important to hit the right target – and in this the Japanese model of concentrating on hidden waste areas can be relevant. It is always easier to measure accurately those things known to be measurable; less easy to compensate for the unknowns. The logical step from such a statement will be the increased

required. These have a different structure to the usual SCADA systems found at refineries and terminals: but there is no reason why they should not become either integrated or effective loss controllers.

Inventory control standards

The demands of the market, for example in the increasing tendency for storage sites to be owned and operated by independent operators, the requirements of the tax authorities; the value of the product; the increasingly stringent environmental legislation; and the need to employ as few operators at site as possible will ensure the need in Europe for such inventory control standards to be maintained. In the United States the proposals to tax fuel and the environmental legislation will ensure that the same path is followed. In other parts of the world not only will the same pressures exist independently but the market will eventually demand that an overall standard is reached; and thus the process will eventually become global.

The example of tank inventory management has been taken to show the diversity of factors affecting control of inventory. How this is done in practice comes down to, for example, a debate between standard temperature accounting (STA) at 15°C transfer and transfer by mass. The difficulties found in control following the discovery of temperature profiles in tanks previously thought to be isothermal has been a spur to the development of mass transfer techniques. It is now clear, however, that mass transfer techniques suffer from many of the same problems as STA. It has been found that density is not consistent through tanks either. Mass transfer techniques may also be more prone to fraud. There are, and should remain for the benefit of everyone in the industry, a number of ways of physically measuring product. These are likely to become increasingly accurate and integrated.

In the Far East different changes are being seen in the market-place. How are yearly growth rates of 25 percent plus catered for? This is a problem which is foreign in more ways than one to a constricting Western market. The rate of change is more important than volumetric



Dioxin in milk scare: result of better measurement

interest in measuring refinery losses and reservoirs over the next decade.

Environmental legislation can only effectively succeed if there is a return on investment. Otherwise, as has frequently been demonstrated, companies can be willing to run the gauntlet of penalties and lobby hard to avoid the required investment. In the case of storage sites, there at least appears to be some validity in an argument that losses via evaporation from tanks can be effectively and profitably reduced by the introduction of vapour recovery systems. Where this is the case, often in conjunction with other operators, further monitoring and control elements are

change. Once again, however, it is EPOS type technology that can assist not only in planning to accommodate the rate of change and growth but also to help the constriction in other markets.

The faster it is known that a change is happening, the easier it is to react to, or plan for. This is similar to Product and Cycle Time excellence programmes in that the faster you can get a product into the market, the greater the profits; early delays mean big profit losses. So with integrated automation and control systems; the profit loss from not doing it now is proportionately greater than not doing it later. This seeming paradox, particularly in an oil business that is careful about decisions, can lead to a false sense of security: but like late product development, there is a real and measurable impact on potential profits which is frequently underestimated.

There have been some moves to develop integrated inventory control systems but these are not widespread. In Belgium bar codes have started to be used for routine maintenance and other tasks. The driver here has been safety – but a by-product will be reduced costs and increased profitability. In the United Kingdom various oil companies are looking closely at integrating their inventory control systems. In Hungary efforts are being made to start with such a system from scratch. Many of these reflect existing approaches.

Approaches to the problem

There have been two ways in which the problem has been approached – the first is to engage a systems house and sensor supplier to provide a bespoke solution to a system. There are advantages to this route in that it gives a single source, single product solution to the issue. The disadvantage is likely to be expense and time. The alternative is to employ a systems integrator with a good knowledge of the industry to combine the benefits of as many of the ad hoc developments together as possible. The advantage of this route is that it is a single source, utilises existing installations where possible and is time- and cost-effective. The disadvantage is no single system.

In approaching the problem, it is important to understand what is required. What is required is the means to control inventory from refining to retailer. This is both

sensors and the automation systems to control the movements. The sensors exist and so, now, do most of the software programmes to implement such an overall approach. What is lacking is an overall imagination to implement the process. The need to make the general system more profitable is unassailable.

'Profitability in the oil business will become increasingly linked to managing the inventory'

The 'downside' to such a development is linked to safety and risk/crisis management. It is here that there are some fundamental differences between the retail world and the oil industry. Further, there are some major differences between process control systems and an overall inventory control system. Safety is a key issue: sites and programmes have to be protected so that they are at least as safe as when manned by people. Hardware and software need to be properly protected and controlled themselves in order to prevent spills, fraud, programme changes etc. This is an area where the oil industry is not always good at handling the problem. If a comparison is made, for example, between the safety measures that exist on board an offshore platform and those at some terminals there is no comparison. The risks, though, are often similar; and in the latter case to many not involved in the industry. It is therefore necessary to balance improved automation systems with improved safety systems. Further there are always the topical environmental issues to consider.

There is a difference between the view, say, of the Health and Safety Executive (HSE), the oil companies and the public on risk. The HSE defines the principle in terms of 'As Low As Reasonably Practicable' (ALARP). The oil companies in terms of Probabilistic Risk Assessment (PRA): the assessment that residual risk is low enough to be tolerable. Both of these assume that a quantitative approach is being taken. There is nothing quantitative in the reactions to disasters nor in the public's perception of risk. These are almost always qualitative. The Royal

Society's report on Risk Assessment states that, 'Risk is inherently multi-dimensional and personal, with a particular risk or hazard meaning different things to different people and different things in different contexts'. The basis of this approach suggests that the 60-a-day smoker and heavy drinker with a history of chronic heart disease in the family will view the construction of an oil terminal close to his home as a significant risk to his future – and we all know, intuitively, that this is so. This has certain implications for the way in which risk assessment is managed. Risk certainly cannot be eliminated and, as shown in the slightly different context of the environmental debate, where this is attempted the overall damage to society may be greater by bankrupting parts of the system and leading to a greater poverty of resource and 'quality of life' in the general sense. Risk does still have to be managed and changes in operational procedures always need to include a revised risk assessment.

Conclusion

The wide ranging nature of this paper should not detract from the relative simplicity of the message. Profitability in the oil business will become increasingly linked to managing the inventory. For a number of reasons there has been a concentration on the marketing area in controlling inventory. This area has a number of similarities with developments in the retail food industry and JIT techniques in transport and distribution generally. The business area is constructed to take advantage of the innovations that have occurred in these comparable industries. If similar developments are looked at there is an inconsistency for the oil business to tackle: such profitable benefits as accrue are greater the faster the changes are made. The oil business does not like to make fast changes. Finally, there is the business of risk: it has recently become clear that there are changes in general perceptions of this too. Risk assessment must, however, keep pace with inventory control. As in other industries the focus for inventory control will shift to those areas currently seen as difficult: refinery loss control and reservoir resources in conjunction with competitors. It is a fascinating time to look forward to. ■

Energy: the risk of underinvestment

By Herman Mulder, Senior Vice President, ABN AMRO Bank N.V.

New world order?

After the simple, bipolar post-World War II world, we are now in the multipolar post-Wall era faced with more complexities and uncertainties. Information travels faster and farther, hence the world has become much smaller, causing a greater orientation on today's global news than on tomorrow's priorities. Also, much physical, financial and political debris of yesterday must still be cleaned, at high costs to the communities. In such environment there is a worldwide trend towards localisation/regionalisation, in which new identities and alliances are developed. Local self-interest seems to be prevailing over broader resource-optimisation. The 1990s will most likely be an era of fragmentation of old structures and reorientation on new ones. Can such house afford a speaker, and can the speaker afford such house?

The reality of such world seems to be one with a basic short term orientation, with only moderate economic growth perspectives (although varying by region), with the need for better infrastructure in many developing regions and for increased social stability to be achieved by

creating local employment. Export markets to OECD-countries are not anymore the primary driving factor for the global economy, intra-regional trade is becoming more important.

Investment climate

A continued low oil price (like today) will become increasingly politically charged as the lack of incentives to develop new (higher cost) upstream facilities will result in an undesirable high dependency on Middle East oil (Tables 1 and 2). Moreover, newly emerging markets (notably in Asia and Latin America) require major investments for regional (rather than export) purposes – refineries, power plants, natural gas transmission and

distribution facilities. Such investments are, as is a common feature of the energy industry, capital intensive and leadtime sensitive (ie require a long-term view/commitment). Yey the capital to make such commitments/investments is still heavily concentrated in the OECD-countries: will such capital be made available for the emerging regional energy sectors?

Global capital: mismatches

A key issue in the world of the 1990s will be to what extent commercial investors are prepared to accept political risks. The general trend seems to be that money travels faster but stays closer to home. Institutional

TABLE 1 – GLOBAL OIL 1990-2010

(x mmb/d)	1990			2010		
	Cons.	Prod.	Exports	Cons.	Prod.	Exports
OECD	38	16	(22)	40	14	(26)
CEE	9	11	2	9	11	2
REST OF WORLD	16	20	4	33	24	(9)
ME + VEN	2	18	16	3	36	33
TOTAL	85	65		85	85	

Source: ABN AMRO Bank 1993

TABLE 2 – PROVED RESERVES, PRODUCTION & CONTINENTS

	OIL			NATURAL GAS			
	Proved Reserves (bln bbls)	%	Production mmb/d	R/P (yrs)	Proved Reserves (bcm)	Production (bcm/a)	R/P (yrs)
North America	32		10.8	8	7.370	621	12
Latin America	121		7.9	42	7.695	85	91
AMERICAS	153	15	18.7	29	15.065	706	25
W. Europe	15		4.5	9	5.672	210	27
CEE	58		8.4	19	55.500	836	66
EUROPE	73	/	12.9	20	61.172	1046	36
Asia	48		6.0	22	9.520	133	72
Australia/NZ	2		0.5	9	2.426	25	97
ASIA/PACIFIC	50	5	0.5	10	11.946	158	5
Middle East	658		18.7	96	92.855	889	104
North Africa	38		3.7	28	5.420	71	76
West Africa	21		3.3	17	3.750	6	625
M.E & AFRICA	717	72	25.7	40	102.025	966	34
WORLD	993	100	64.0	100	190.208	2.876	100
bin boe mmboe/d					1158	17.5	

Note: */* = Reserve/Production Ratio

CEE: Central & Eastern Europe

investors from the OECD-countries are generally not interested in foreign investments and also commercial banks apply strict country lending limits (Table 3). Moreover, in an uncertain world with low oil-prices, investors (even oil companies) are staying short and liquid, playing margins rather than committing for long-term projects as is required for a balanced development of the world's energy industry. Such balanced development in the oil and gas sector necessitates some \$175 billion per annum to maintain the present capacities, to which the top 25 western oil companies may, theoretically, contribute some 40 percent (Tables 4 and 5). But will they? Indications are that, worldwide, probably only some \$100 billion per annum will be invested. There is, generally no absolute shortage of capital but it is in the wrong place and chasing shorter-term opportunities.

The question is whether OECD governments are prepared to stimulate the necessary energy investments by official Export Credit Insurance Agencies (ECAs), MLA-programmes. The US administration is already showing the way. The latter ones, such as the World Bank and the EBRD, have absolute capacity limits and have a broader multi-country multi-sector mandate.

The ECAs must clearly be a major source of capital support, protecting the exporter (or his financier) against political risks in non-OECD countries: the pressure on them will only become stronger as the political risk perception of investors becomes bleaker.

Hence, there is the risk of under-investment in the energy industry during the 1990s because of the combination of low oil prices, global fragmentation and commercial investors' short-term, closer-to-home orientation. The issue is what price OECD governments are prepared to pay to realise a stable, diversified energy development. For Western Europe this is particularly the case in its relationship with the former Soviet Union.

Special case: Former Soviet Union

The tangible flow of commercial funds to the FSU-republics (and Russia in particular) will for some time to be, to say the least, not be in line with the enormous potential of the region and the requirements for such potential to be exploited for world energy markets in general and concerning natural gas for Western

Europe in particular (Table 6). The FSU-republics are in a major way different from other countries in transition: they do have an enormous combined base of natural resources, industrial capacity and human resources and they have the political and social necessity to accelerate their transition process towards a market economy.

Additional risk protection should be offered to international investors/lenders for lack of title, lack of authority of administrative bodies/counterparties, undue change of taxation/duties/permits, incur-rence

of unknown liabilities (e.g. environmental, social), hyperinflation, (interest free) reserve accounts with Central Bank, unfair dispute settlement. Or, more broadly defined, any event caused by (federal and/or local) government (in-) action with a relevant adverse effect on the value of the investment/loan (as established by an ex ante, agreed feasibility study). Such extra coverage should be granted by the Western governments wishing certain projects to be developed also in their own interest (like the oil and gas sector in the former Soviet Union, which is of direct interest to

TABLE 3 - FINANCIAL & NATURAL RESOURCES

Rank	Country	Score	Rescheduling	Secondary Market	Proved Reserves Oil	Gas
1	Japan	99				
2	USA	99			26.2	4.7
3	Switzerland	99				
4	France	98			0.2	
5	Netherlands	98			0.5	2.0
6	Austria	98				
7	Germany	98			0.4	0.2
8	UK	98			3.8	0.5
9	Canada	98			5.8	2.7
10	Belgium	97				
12	Denmark	95			0.8	0.2
13	Norway	95			7.6	2.4
15	Australia	93			1.6	2.3
19	New Zealand	91			0.2	0.1
23	Italy	88			0.7	0.3
25	UAE	82			98.1	5.8
26	Saudi Arabia	79			257.5	5.2
27	Bahrain	79			0.1	0.2
30	Kuwait	75			94.5	1.5
33	Malaysia	73			2.9	1.7
34	Thailand	73			0.2	0.2
35	Brunei	73			1.4	0.4
36	Qatar	70			4.5	6.4
37	Oman	69			4.3	0.5
41	Indonesia	62			11.1	3.0
42	China	61			24.0	1.4
44	Turkey	59	n		0.7	
46	Mexico	55	y	74	52.0	2.0
49	Colombia	53	n		2.0	0.2
51	Tunisia	52	n		1.7	0.1
54	PNG	49	n		0.2	0.4
55	India	48	n		8.0	1.1
58	Venezuela	45	y	70	59.0	3.5
62	Argentina	42	y	56	2.3	0.6
65	Pakistan	40	n		0.2	0.6
66	Brasil	40	y	57	2.8	0.1
68	Algeria	40	y	55	9.2	3.6
69	Trin & Tob	40	n		0.5	0.5
70	Iran	40	n		92.9	19.8
74	Romania	37	n		1.2	0.5
81	Syria	35	y		1.7	0.2
85	Egypt	34	y	46	4.5	0.4
88	Gabon	32	y	38	0.7	
91	Ecuador	32	y	33	1.4	0.1
93	Nigeria	31	y	33	17.1	3.4
95	Bolivia	30	y		0.1	0.2
96	Cameroon	30	y	15	0.4	0.1
107	Yemen	27	y		4.0	0.4
123	Vietnam	24	y		0.5	
125	Angola	24	y	18	2.1	
127	Myanmar	23	n			1.0
128	Peru	23	y		0.4	0.3
129	Lybia	23	n		22.8	1.3
148	Kazakhstan	19	y		57.0	55.0
149	Russia	19	y	36		
154	Congo	16		8	0.8	0.1
157	Iraq	14	y		100.0	3.1
167	Sudan	10	y			

Source: Euromoney 3/93; various other sources

particularly Western Europe). It is estimated that the Russian oil industry may need some \$50 billion to stabilise at the level of the late 1980s. Current World Bank/EBRD programmes do not exceed \$1-1.5 billion annually. Moreover, some issues like the World Bank's negative pledge and dissatisfaction with the speed of the reform process in Russia create further obstacles.

What is in our view needed for the former Soviet Union is a multilateral scheme which:

1. **accelerates the earning (!)** of hard currency income through the rapid development of large energy projects with a low economic threshold: e.g. rehabilitation/debottlenecking of oil/natural gas pipelines;
2. **allows the maximisation of the regional industrial contribution** (supply + services) to such projects despite the absence of effective local capital markets; the export volume of energy is the key for the degree of hard currency borrowing;
3. **enables the early tangible involvement** of the western energy-industry (including alongside investors, such as commercial banks) without incurring undue non-technical/commercial risks;
4. **offers financial instruments** which may be used for projects which comply with clearly defined commercial conditions;
5. **is bold, offering clear positive perspectives** to the whole of Europe: creating employment, increase energy cooperation, enhance political and social stability, adequately addresses environmental and safety issues (as called for in the European Energy Charter).

In a balanced way, the scheme should allocate the different types of (technical/commercial versus political) risks among all interest holders from public and private sectors.

The general outline of the European Energy Private Investment Support Scheme (EPIS), as proposed by us, is as follows:

1. It offers to private investors (lenders and also equity investors) guarantees by the EC and other OECD countries for the risks associated with energy projects in the FSU republics to the extent existing political risk coverage is not available from the official Export Credit Agencies. Such

coverage is limited to the exports of goods and services from the West into the former Soviet Union (rather than imports of energy from the Soviet Union into the West) and to the traditional political risk coverage (expropriation, political violence, currency non-convertibility/-transferability, government breach of contract), which is too limited in a very unstable legal environment such as Russia.

2. Its basis is the value of (contracted) energy exports from the former Soviet Union into West European markets at competitive prices (i.e. the reverse from classical export financing schemes, whereby western governments offer (bilateral) coverage for capital goods and services exported by them). It therefore offers hard currency benefits already during the construction phase, since the hard currency value of the export contract of energy is well in excess of the costs incurred in hard currency, as a result of which local development costs may be partially funded by hard currency credits/investments.
3. The eligible projects must be considered commercially sound (established by a comprehensive feasibility study), must have an

adequate project structure and must be qualified by the OECD governments involved and the host republic as having priority status. Western energy companies must have a significant direct or indirect interest in the project.

4. The amount of guarantees available under the scheme may initially be limited but should be significant enough to be an effective catalyst i.e., at least ECU 10 billion. Also the window of availability may be limited to perhaps five years (although coverage under the guarantee may be offered for as long as 20 years). The scheme is, of course, optional but if called for a guarantee commission is due by the project sponsors. Also, a certain degree of own risk for the investors seeking coverage is required.

Risk: underinvestment in 1990s

Pre-production financing by commercial banks is well established in the OECD countries; hence their capital may be leveraged by debt. Such leverage is not possible in many non-OECD countries because of political risks, limiting commercial bank financing to pre-export financing or even only post-export financing: the realisation of the

TABLE 4 - NORMALISED MODEL 1993-1997

ASSUMPTIONS			
GNP-growth	:	OECD + 2-2.5% p.a.	
	:	EX-CPE - 3% p.a.	
	:	Other +2 - 4% p.a.	
Oil demand	:	0.5-1% p.a. (i.e. 69 MMB/DIN 1997)	
Replacement cost	:	\$6/BBL	
Reserve replacement rate	:	1.0	
Minimum reserve life	:	10.0 years	
CONCLUSION			
	Production 1990 (x mmb/d)	Capacity 1997 (x mmb/d)	Capex p.a. (x \$ bin)
OPEC	25.4	30.0	15
OECD	18.3	16.0	20
EX-CPE	10.7	9.5	15
Other	19.0	16.5	30
Total	65.4	72.0	80

TABLE 5 - FINANCING CAPITAL EXPENDITURES 1993-1997

Capital Expenditures p.a.		Financing p.a.	
Production Oil	80	Top 25 private	
Natural Gas	40	oil companies	70
Production	120	Other investors	102
Transportation	12		
Processing	31		
Marketing	7		
Other	2		
Total (\$ bin)	172	Total (\$ bin)	172
<i>note: based on '74-'83 percentage</i>		<i>note: average top 25 cics: '74-'83: 48% '93-'97: 40%</i>	

economic value of the energy asset to be exploited is directly affected by political and/or legal instability in the host country.

In conclusion, to mobilise the necessary funds for balanced energy development in the non-OECD countries, the roles of regional development banks and intra-regional commercial funding sources (banks or public) must be strengthened, supplemented, notably in the case of the former Soviet Union, by new financing schemes which go beyond traditional techniques for co-financing (by MLAs) and political risk coverage (by ECAs). Only then the international commercial banks may be mobilised in a major way. If not, during the 1990s the energy industry at large may be suffering from heavy under-investment which, together with a low oil price, may result into a less stable global energy development. ■

TABLE 6 – EUROPEAN NATURAL GAS PERSPECTIVE (X BCM/A): 1992-2010

	1992	2010	
Consumption	Germany	65	75
	United Kingdom	63	71
	Italy	52	65
	France	35	40
	Spain	7	10
	Other West Europe	70	111
	West Europe	292	372
	Central Europe	87	130
Total	379	502	
Production	Netherlands	75	75
	Norway	32	58
	United Kingdom	45	55
	Italy	17	16
	Germany	16	10
	West Europe	185	214
	Central Europe	40	25
	Total	225	239
(CIS)	750	1100	
Imports	CIS	110	110
	Algeria	35	50
	Other (Including CIS)	9	103
	Total	154	263

Source: ABN AMRO 1993

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Latest news from Turkmenistan

By Juliette Rossant

Since declaring its independence two years ago, Turkmenistan's gas and oil sectors have been plagued by regional instability and transport problems. Wars in nearby Azerbaijan and Tajikistan as well as unstable neighbours like Iran, Afghanistan and Uzbekistan have worried potential foreign investors. Many large foreign companies refrained from bidding for exploration and drilling rights in the first two tenders held in the Turkmen capital Ashgabat (formerly Ashkabad) in 1991 and 1992. However, when the results of the most recent tender were announced on 15 November by Oil and Gas Minister Nazar Suyunov a major international company was one of the winners. Observers believe that the government may now be closer to choosing a route for a new gas pipeline which would solve transport problems.

Turkmenistan has the world's third largest reserves with 13 billion cubic metres of natural gas. Annual production is currently 65 million cubic metres, only 8 million cubic metres used domestically and the rest exported to other Commonwealth of Independent States and Europe. Annual production levels are falling, exports still represent 90 percent of foreign currency earnings for the desert republic. Turkmenistan also produces 5 million tons of oil annually from onshore and offshore fields in the west of the country.

Winning tenders

Turkmenistan's gas and oil sector received a substantial boost from news, announced on 15 November, that Occidental Petroleum Corp won a tender to explore and develop gas and oil deposits in the third international tender. This marks the first time a major international oil company has invested in Turkmenistan and may give a much needed push for a decision on a pipeline and encourage other international players to follow Occidental's lead.

Occidental Petroleum put up a \$20 million signing bonus for block six, while another American firm, Oil

Capital, together with Turkey's Lapis Holding in a consortium with TYT Bank won block one with a \$30 million initial bonus.

Four international companies bid in the tender, although 30 companies were involved in preliminary talks and 13 had registered for the tender. The other companies involved in the tender were: British Gas, Enterprise, Unocal, Arco, Chevron, Canadian Oxy, Oxelot, Larmag, Turkish Petroleum, USAHAT and EGHS (Malaysia).

The new companies join three foreign companies which have won blocks in the first two tenders. All are newcomers to the international scene. Argentina's Bridas is already exploring in one of its two blocks.

Three blocks in western Turkmenistan were offered in this current round. Block one which includes the Livanov, Barinov and Gupkin fields is 1,900 square kilometres offshore in the Caspian Sea, part of the Apsheron trend. Block five is the Barisa-Gelmez fields, 275 square kilometres onshore. Block six is the Burun field of 224 square kilometres onshore. All three blocks included oil and gas. All have proven reserves and block five and six, although small, are already in production. The three blocks have

combined probable recoverable reserves of 1 billion barrels of oil.

The latest tender has been run on similar terms to the first two. These include a \$30-\$40 million bonus, all joint ventures with the state-owned Balkanefte with varying percentages. The blocks are all up for exploration, production and sale in 25-year contracts.

The greater interest in this latest tender was due to the growing reputation of Turkmenistan as a stable country. 'Turkmenistan wasn't well known,' said Denver-based Wavetech Geophysical president Ed Gendelman, 'Companies have had to get used to the idea that it's a major oil and gas province'. Wavetech Geophysical is coordinating the tender for Turkmenistan.

Turkmenistan's next scheduled bid is at the end of 1994. According to the president's plan unveiled in Brussels in March, tenders will be offered until 2030. A gas pipeline is scheduled to begin construction in 1994. The plan predicts that by 1996 profits from the oil and gas sectors will exceed investment.

Prior to the tender, the government began a series of economic reforms aimed at introducing the first steps towards a free market economy.

These included issuing its own currency (the manat), freeing some prices for consumer goods and starting an ambitious privatisation programme of small and medium industry. Foreign oil companies working in Turkmenistan have welcomed the news. 'The country is well prepared,' says Bidas general manager Pedro Schereiterer, 'we expected this change. The monetary reform is a good step.'

But President Niyazov has not loosened the political reins of the government. He has ruled Turkmenistan with an iron fist, since 1985, first as First Party Secretary then an president, elected unopposed in 1991. President Niyazov allows for little political instability. Censor is total and the tiny opposition is in and out of police detention.

Gas pipeline projects

Government officials said that they were close to making a decision on a new pipeline to carry natural gas to Europe. They have set up a working group to map out a route for a gas pipeline, organise tenders for construction and arrange for financing. The group is led by President Saparmurat Niyazov and includes the former US secretary of state, Alexander M Haig Jr and his business partner Michael Ansari who together started US-CIS this year to promote Turkmenistan in the United States and Europe. It also includes

the chairman of Argentina's Bidas and Mr Suyunov.

There are several different pipeline routes under consideration:

- 1 **One running east to west** through Turkmenistan crossing under the Caspian Sea to Azerbaijan, Iran and Turkey and then across to Europe. A variation would bypass Azerbaijan travelling directly from Iran to Turkey.
- 2 **One running east to west** through Turkmenistan then crossing into Iran near Tabriz and into Turkey near Dogubayazit and then across Turkey into Europe.
- 3 **One similar to number one but** continuing through Azerbaijan to Armenia and Turkey.
- 4 **One extending the existing** pipeline through Georgia, Uzbekistan, Kazakhstan and crossing Turkey.
- 5 **One similar to number four** but crossing Russia on the path of an existing pipeline.

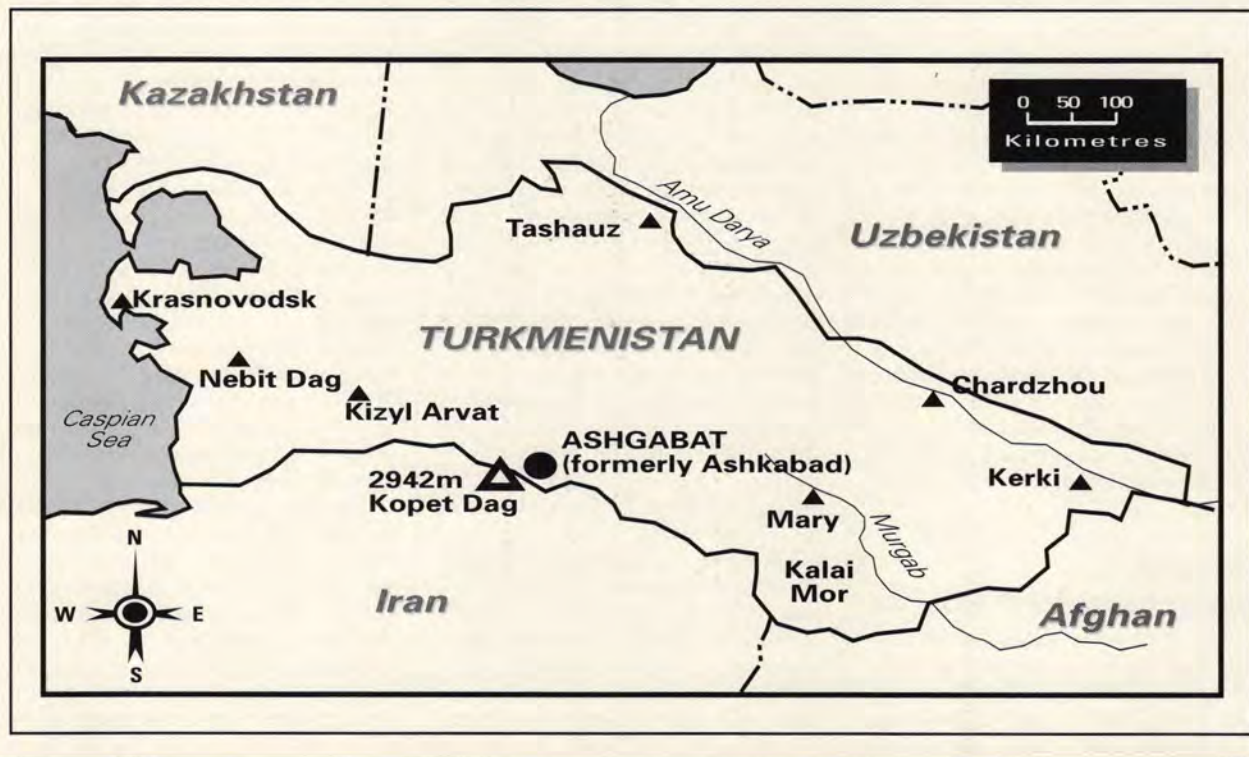
There are also plans to build a petroleum pipeline from Turkmenistan to the Gulf through Iran.

The Turkmen favour a \$1.9 billion pipeline following route one to carry 15 billion cubic metres of gas annually. President Niyazov signed a letter of intent on the pipeline with visiting Iranian President Rafsanjani in October. Iran and Turkmenistan

share a 1,500 kilometre border. The two countries also signed a 15-year friendship and cooperation treaty which is intended to boost trade and transportation links between them.

In a separate project, Turkmenistan has plans for a gas pipeline to a Chinese liquefaction plant on the Yellow Sea from where gas could be shipped to gas-hungry Japan. The route for the pipeline would run west to east in Turkmenistan through Afghanistan, Pakistan and across China. An alternate route would follow existing pipelines in Uzbekistan and Kazakhstan and then to China. A trade agreement was signed in Beijing in December 1992 followed by discussions between President Niyazov, Chinese officials and representatives of Japan's Mitsubishi Corporation.

Bidas is still the only company active in Turkmenistan. It won a block in the first tender and one in the second. UAE's East Pak won one block in the second tender along with Bermuda-registered Larmag which also won a block in the second round. Neither of these two companies has started operations. East Pak has hired Monument and Santa Fe as their operators. All three of these companies are relatively small, so they were able to make quicker decisions than the major oil companies. Bidas had made a strategic decision to become an international company at the time when Turkmenistan was planning its first two tender offers. ■



Independence of Baltic states forces major energy rethink

By John Cranfield

Forcibly incorporated into the USSR for 50 years, the Baltic states are today trying to regain economic as well as political independence. And the energy industries are probably having more of a struggle than most. For energy was totally integrated with Russia. Of the three states, only one has its own oil refinery, designed for and totally dependent on Russian crude. All gas comes from Russia, while the integrated electricity system means that each country is heavily reliant on its neighbours.



To some extent, integration may prove beneficial. Although total dependence on Russian oil and gas can be over-come, it is to a degree balanced by electricity exports from the Baltics to Russia. Unhappily for total economic independence, the Baltics were always treated by the USSR as one entity, not three. So, for years to come, they are likely to have to work together, like it or not. Luckily their 20 years of independence between the two world wars suggests that they could and did work fairly well together. Today all three are drawing on past friendships, not only between themselves but with neighbours from whom they were long cut off. So Finland and the Scandinavian countries are once more playing a significant role in the region.

Estonia – power house for the region

Of the three states, Estonia is the only one that has ever been able to claim energy independence. But that was in the 1930s, and based on peat, oil

shale and some hydropower. Oil-shale mining only began in 1920, reaching output around 600,000 tonnes/year (t/y) in the 1930s. Some was used as mined as power-station fuel and, pulverised, as general boiler fuel. A great deal was also retorted into crude oil, itself distilled into products. Peat was also much used as power-station fuel. Peat use died out and oil-shale processing was abandoned (Estonia at one time exported crude shale oil) and as-mined shale became the standard fuel for Estonian power stations. Output grew hugely, to 20 million t/y just before independence was regained. A further 2.3 million t/y was processed to provide raw materials for the chemicals industry. And power stations imported a further 2.2 million t/y from the Russian part of the oil-shale fields.

All that is set to change. Although oil-shale reserves are still about 1.7 billion tons, the use of as-mined shale as fuel is highly polluting. Four power plants, with a combined 3,105-MW capacity, use the fuel, two of them built quite recently. But all are

in dire need of clean-up. One plan, for the newest station, is installation of new furnaces based on fluidised-bed combustion technology. That would clean up substantial sulphur emissions. But the two older plants, both small, are planned for phase-out by 2005. In their place would come a new, modular, coal-fired plant, rated at 420MW instead of the 60MW of the old units but finance is a problem. Finland is mulling ways to provide finance in exchange for some of the plant's output, delivered via a new subsea cable across the Gulf of Finland. The new station would be at Tallinn, while a second plant, rated at 200MW would be built at Tartu. All shale-fired plants are located in the mining area around Kohtla-Järve near the Russian border.

Any change will have to be discussed with Latvia and Lithuania. For Estonia uses only about 40 percent of the power it generates. Of the rest, 20 percent goes to Latvia, 21 percent to Russia and the rest is lost because of inefficient plant and transmission systems. Latvia would have to either build new plants of its

own or come to a new arrangement with Estonia. The problem for Latvia is exacerbated because it also gets much of its power from Lithuania's one nuclear station, at Ignalina. That too is on the phase-out list since it uses unreliable Russian technology.

Estonia's role of major power generator is vital to the Baltics as a whole. But when it comes to oil, the boot is on the other foot. Estonia has no refinery and has a demand running at some 3 million t/y. That traditionally came from the Baltics' one refinery, the 260,000 b/d Mazeikiiai plant in Lithuania. But that plant, totally dependent on Russian crude, had its supplies cut back hugely last year and is now running at only about 40 percent capacity. The Estonians had foreseen problems here even before formally reclaiming independence, for products supplies were becoming haphazard long before the USSR broke up. So, with official blessing, in mid-1991 local firm Eesti Kutus formed a joint venture with Finland's Neste to build a new import terminal at Tallinn.

Ownership is 55 percent in Neste's favour and the first stage opened in August. Estonian Transoil can now handle 60,000 t/y of gasoline and diesel oil, imported by sea. When the second phase is complete, early next year, capacity will rise to 80,000 t/y. Cost is \$50 million.

A similar joint venture was put into play in mid-1992, when Pakhoed got together with N-Terminaal to build a second import terminal at Tallinn. Initial storage capacity will be 50,000 cubic metres, with expansion to 125,000 cu m a possibility. Both oil

products and chemicals will be handled. Earlier this year, the government decided to sell seven existing terminals operated by the state-owned and near-bankrupt Estonian Fuel. The remaining assets would go into a new joint venture with Russia's Lentransgas, which would hold a 30 percent stake. Estonian Fuel handles 50 percent of the country's gasoline marketing and sells 65 percent of all diesel and fuel oil used. Those interested in buying terminals from the state include Russia's Lukoil, Finland's Neste and Norway's Statoil. The latter two recently entered the local gasoline-retailing market, building new filling stations and planning more.

On the gas front, Estonia's problem is political. In June, Russia cut off supplies for a while in protest against what it sees as discrimination against the large Russian population who have in effect colonised Estonia since it was forced into the USSR. But on the economic side, the position is more stable. In May 1992, Russia agreed to provide 1.92 bcm for that year and a joint-stock company was proposed to handle distribution. Under the original scheme, this would have included a western stake of 20 percent but in the event Nesti Gas was finally formed early this year as a partnership between the government (70 percent) and Lentransgas (30 percent). However, as the country improved its supply of other fuels, gas demand has fallen, to just 880 MMcm in 1992-3 against 1.5 bcm the year before.

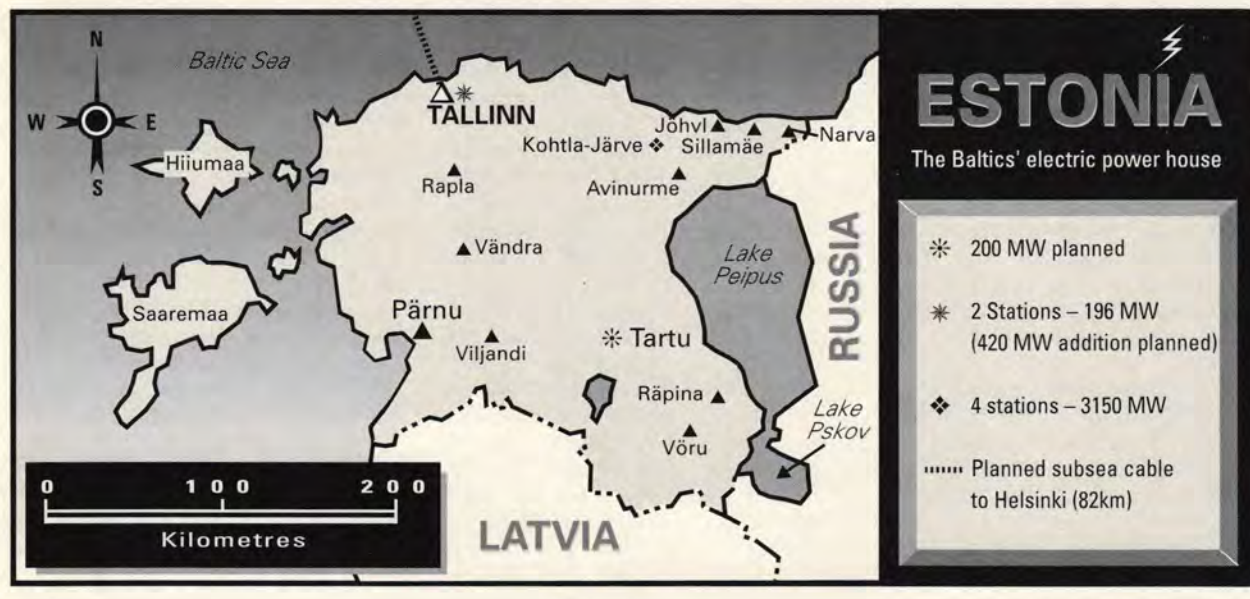
Long term, plans have been put together, with a great deal of help from Dansk Olie & Naturgas, for a joint gas system with Latvia and Lithuania.

Initially this would sort out grid problems: there are, for instance, no metering stations. Further ahead, a tentative plan exists for a new supply system that would involve North Sea gas. Named Polpipe, the system would cross Denmark and the Baltic Sea to Poland and, possibly, the Baltics. But this remains very much a dream at present.

Latvia - local oil could cut import dependency

Energy consumption in Latvia is 50 percent oil, 40 percent gas and 10 percent coal, all from Russia. Other energy arrives as imported electricity from Estonia and Lithuania. Oil demand averages 5.5 million t/y, tapped off the Russian products pipeline to Ventspils, long a major outlet for Russian sales to the west. Latvia is keen to diversify but that means either doing away with the Russian transit trade which is falling sharply anyway - and reversing the Ventspils line so that it can handle imports, or building a completely new import system. Plans also exist for a 40,000 b/d refinery so that products dependency on Russia can be cut.

In the short term the problem has been solved by the formation of a joint venture to operate the Russia-Ventspils line. Russia's Transneft and the Samara refinery will hold 49 percent between them, the Latvian government 41 percent and two private Latvian firms the remaining 10 percent. Local state oil firm Latvijas Nafta is being privatised, though the state will retain five storage sites to hold strategic reserves. And the retail market is being opened



up, Neste being one of the first foreign firms to move in. A further way of securing supplies comes via the imposition of a 6 percent transit levy on Russian products exports, to be taken in cash or kind.

Longer term, it is planned to open up the country to foreign explorers. Fields already producing could, according to local reports, be further developed such that they could produce 20,000 b/d. And seismic conducted by the National Geology Department suggests that reserves exist sufficient for up to 50 years' demand.

Gas is more of a problem, given its high usage level. Latvia holds the only peak-storage facility in the Baltics and, because of a lack of metering, fears that Russia could simply drain reserves if problems arise. So Latvia paid up pretty promptly this summer when Russia threatened to cut off supplies unless back debts of \$4.4 million were cleared rapidly. The future depends either on a more stable relationship with Russia or the development of new supply routes. And, because all Latvia's gas arrives via Lithuania or Estonia, joint action is most likely.

Lithuania – downstream assets hold key to future

As the most populous Baltic state, Lithuania has an oil demand averaging 8 million t/y. And it has the only refinery. However, the Mazeikiiai plant is only running at part capacity because of low Russian crude deliveries. On top of that, it needs modernisation to the tune of \$400 million, even though it was built as recently as 1980. Some product was exported during the Soviet era, by rail via the port of Klaipeda. Last year, Russia agreed to supply 3 million t/y of oil, plus 2.5 million t/y from joint-stock enterprises, which can sell direct. That is nowhere near demand, neither does it go anywhere near meeting the refinery's 15 million t/y capacity.

Last year, Lithuania offered Mazeikiiai capacity for third-party processing. So far only Russia's Tatarstan Republic has taken up the offer, supplying 11 million bbl.



Products are exported. Tatarstan is also investing in the modernisation of Klaipeda export terminal, while Lithuania is to invest in Tatar upstream projects. Hopefully, that will result in some secure oil supplies. Also aimed at improving supply security is a mid-1993 plan to build two 140 km pipelines between Ventspils in Latvia and the refinery. One would handle crude imports from non-Russian sources, the other would carry products for export.

This plan would replace an earlier scheme put forward by Fluor Daniel, costed at \$308 million. It would involve the construction of a new terminal, 30 km south of Klaipeda end a pipeline to Mazeikiiai to handle 9 million t/y of imported crude. However, the terminal site proposed is opposed by the Ministry of Environment. Yet another scheme being studied is for a new terminal at Butinge, rear the Latvian border, with offshore tanker unloading. A 94.5km pipeline to the refinery would be scaled to handle 12 million t/y of crude and 5.2 million t/y of products. Cost is put at \$170 million, making it less costly than the Ventspils option and less sensitive than the Fluor plan. That it could be the chosen option was partially confirmed in September, when \$5 million was earmarked for preliminary design work. Late last year, Italy's Snam offered to build the pipeline link, though at that time the terminal site had not been chosen.

Yet more security will stem from the development of Lithuania's own small oilfields. In May, the Gargzdai State Oil Geology Enterprise formed a joint venture with Svenska Petroleum (SP) to develop the Genziai field, said to have 10 million bbl reserves. SP aims to invest \$15-30 million, aiming at production of 4,000 b/d within two or three years. Potential is put at 6,000 b/d. All told, Gargzdai claims to have found nine small fields, including Genziai, with total reserves of perhaps 120 million bbl. An unidentified German firm is also keen to take on development but nothing has been firmed up yet.

Refinery modernisation began late last year, when Foster Wheeler and Hytech won a \$50-million contract to provide engineering and procurement for a 190,000 t/y alkylation plant.

Lithuania has not had quite the same problem with gas as its neighbours. This year, Lentransgas agreed to supply 4 bcm – much the same as in 1992 – to local utility Lietuvos Dujos, with hard-currency payment. However, Lithuania owes \$30 million for earlier supplies and, in September, proposals were put up to deal with some of this. A new utility would be formed, with Russia's Gazprom and Lentransgas holding a joint 50 percent stake. This could require a local law, which restricts foreign ownership to 49 percent, to be changed. Again, the long-term future may lie with Polpipe and supplies from the west. ■

Exploration and Production

The contract for the Institute to assume BSI responsibilities for PSE 17 Committee is near to agreement. The outstanding issue of third-party liability insurance has now been resolved.

The IP attended the Plenary Sessions of ISO/TC 67 in Assen in September on behalf of BSI.

The IP is administering a joint UKOOA/DTI conference 'Strategies for Cost Reduction in the New Era' on 2 and 3 December at which the final report of the CRINE study will be presented.

Results of the study by W.S. Atkins on the Routine and Non-Routine Cases for subsea equipment operating envelopes were presented to a very successful workshop organised by the IP in Aberdeen on 13 October. Feedback from the wide cross-section of the industry present at the workshop was very positive and is currently being incorporated into an IP Guideline Document.

A summary of the final report by Trident Consultants on 'The Development of Design Guidelines for Protection against Over-Pressures in High Pressure Heat Exchangers' is being prepared. The second phase of this project, may involve theoretical studies in 1994 supported by some material testing the following year.

Refining and Marketing

The Code of Practice for Fire Precautions at Petroleum Refineries and Bulk Storage Installations was published.

The Code of Practice for On-Board Truck Computer (OTC) Systems was issued for ballot in mid-November to oil industry and equipment manufacturers both in the United Kingdom and abroad.

A draft guideline on performance requirements for pipework used as part of underground fuel supply systems at service stations has been prepared. Copies have been sent to pipe manufacturers in Europe and the United States, HSE, APEA, LACOTS and PRA.

Formal comments have been made on the DTI de-regulation draft report and recommendations on issues affecting the construction and operation of petrol service stations in the United Kingdom.

A conference was held on the practical implementation of EC gasoline vapour emission control directives. The conference was held in conjunction with a manufacturers' exhibition at the Institute.

A research contract has been agreed for a QRA study of Road Tanker Gasoline Vapour Balancing and Recovery Systems.

Research contracts have been placed for the Risk Assessment of Protective Multiple Earthing at Service Stations.

Aviation Committee has been represented at meetings in Europe concerned with aircraft fuellers, petrol tankers and service station storage tanks. These are ongoing commitments.

Microbiology

A successful conference on 'Developments in Microbial Control in Metal Working Fluids' was held in October (see page 552).

Work by the Microbiology Fuel Group to produce 'Guidelines for the Investigation of microbial content of Distillate Fuels' continues.

Petroleum Measurement

Discussions are taking place with ISGOTT about safety issues associated with manual gauging that are required to be added before publication of PMM Part III: Manual Tank Gauging: Part 1, Non-Electrical Methods. An amended version of the document has been submitted to ISO/TC 28/SC 3 as a Committee Draft document. Some modifications are expected in ISO Committees to reflect the different practices which prevail in other countries.

Statistics for Static and Dynamic Measurement and User Guidelines for Standard Temperature Accounting have been published.

Environment

The Oil Dispersants Sub-committee has made a submission to MAFF to assist them in the review of their 'UK Oil Dispersants Testing and Approval Scheme'.

WRc Alert has completed its work on the production of a 'Part of a Sector Application Guide for BS 7750 for Oil Refineries, Dealing with Environmental Effects Assessment'. This report will form the basis of an IP guideline for the assessment of the effects of refineries on the environment which is being developed by the Refineries Environmental Effects Sub-committee.

The Environment Discussion Group have held two successful evening meetings on 'The Work Being Done by IPIECA' and 'The Treatment of Oil Spills'.

Test Method Standardisation

The text of the 1994 edition of the 'Standard Methods for Analysis and Testing of Petroleum and Related Products' has been submitted to the publisher.

The work has started to develop a number of new ISO Standards based on existing IP test methods. These include 'Flash Point by the Abel method' and 'Density Using a Digital Density Meter'.

Work has commenced to develop a new test method for the 'Determination of Oil in Water' using hexachlorocyclopentadiene as the extract solvent to replace Freon 113 which is currently used. This is being developed in direct response to the needs of the oil industry and the UK regulatory authorities. Once established as an IP standard, the aim will be to develop this method first as a British Standard, then an ISO Standard and an European Norm.

Health

The Occupational Health Code of Practice was published in September.

Guidelines for Health Surveillance and Biological Monitoring for Occupational Exposure to Benzene were completed and published.

The work on the Epidemiology Study of Refinery and Oil Transportation Workers continues with the development of a database of job histories and estimates of exposure to petroleum products for case studies.

Comments have been made to the HSE on their Metal Working Fluid guidance documents.

John Hayes, Technical Director

Lifetime learning for engineers

A discussion document 'Review of Engineering Formation' circulated by the Engineering Council suggests that the process by which professional engineers are formed - both their initial education and their further training and development - must undergo a fundamental culture change in order that the engineering profession can best meet the future needs of a rapidly changing business environment.

A system characterised by an emphasis on 'one-off' registration and which is perceived as locking people into a 'class system' based on early opportunities for study must give way to one embodying more flexible, variable and progressive pathways to achieving certificated professional qualifications.

In the next century professional engineering competence must be based on the twin pillars of Foundation Learning, the initial education of engineers which will provide breadth of learning and the necessary skills and attitudes for the future, and Lifetime Learning, the continuing professional development which leads to full competence in the real working environment.

In consequence the existing three-tier structure by which professional engineers are registered will have to be redefined to remove the concept of a 'single progression route' and also to make some of the criteria involved more demanding.

Three new categories of professional registration are proposed, of which the lower two will effectively combine elements of the three existing classifications, while the requirements for the highest tier will be more demanding than those for the present Chartered Engineer status. Progression between the three grades will take place by means of credit accumulation, accreditation of prior learning and NVQs (National Vocational Qualifications), all underpinned by a sound educational base.

The hallmarks of the new systems will be diversity of provision, flexible personal development paths, competence-based qualifications and individual responsibility for learning and career development.

Individuals will achieve professional recognition through a mix of technical ability, business and communication skills, personal effectiveness and high personal standards of conduct.

The document was produced by three working groups drawn from academia, industry and the engineering profession, supported by consultants jointly funded by the Employment Department.

The working groups analysed the main challenges that will face industry up to the year 2010 and argued that engineers will need not just a foundation in generic knowledge and skills, information systems and new materials but also customer relations, team working, foreign languages, project management, product improvement and innovation.

The Engineering Council itself agreed directional statements in four basic areas:

- National targets and international comparisons.
- Pathways to engineering professional practice.
- Convergence between NVQs and the Council's existing standards and routes to Chartered status.
- Quality assurance, accreditation and quality assessment.

Focused Action Learning gives real payback

At a recent personnel education and training evening discussion group meeting members were fascinated to hear Chris Brooks of Shell Chemicals describe how Action Learning had made a real measurable positive net contribution to business profits.

He outlined some of the activities being carried out by Shell Chemicals in northwest England amongst a group of 16 junior managers. These staff from all parts of the company and with varied backgrounds, entry routes and experiences but all themselves motivated and with the active support of their Line Managers participated in a 10-month BTEC accredited scheme integrated into the business programme and objectives.

Mr Brooks described the Action Learning process in which the participants were required to carry out projects sponsored by businesses. The projects had in turn been selected from areas previously identified in the corporate quality plan as requiring improvement. The projects need to be realistically achievable within the time set aside for the Action Learning process but should also preferably be cross-functional. The participants learnt through a social process with and from others in their group how to take effective action and indeed learn from their actions. The mutual support within the groups of four or five staff enabled all to learn with a minimum interaction with the outside facilitator. This contributed to keeping the direct costs low.

Completed projects have made a contribution of more than £400,000 to the bottom-line, whilst the projects due for completion this year by other groups have identified a similar contribution.

Mr Brooks believed that the projects are making a real contribution to increasing the business profitability as well as helping to break down some of the traditional boundaries which have developed between different parts of the business. It has also aided the personal development of the participants in the Action Learning as well as other staff they have contacted during the projects.

GIRL WINS TOP ENGINEERING PRIZE

For the second year running a girl has won the top title of 'Young Engineer for Britain'. Lucy Porter, 16, from Bath, won the coveted trophy, a £500 personal prize and £1,500 for the purchase of engineering equipment by her school. She also carried off the Women into Science and Engineering award of £500 for the best project by a girl.

She won the awards by inventing a swing exerciser for children with special needs, who are unable to use their legs. She plans to be an engineer and said: 'Engineering is really addictive - it is so satisfying to design and make something which can solve a problem.'

The oil industry also benefited from the originality and enterprise of young engineers through one of the additional prizes. IBM gave a prize of an IBM personal computer for the best use of information technology in a project. Stuart Cowley, aged 18, of Billingham, carried off the prize for his lubrication advice service.

Welcome for NVQs

National Vocational Qualifications look set to enter science, technology and mathematics after a survey showed that they would be welcomed by universities, industry and professional bodies.

The Institute of Petroleum, major companies, industry lead bodies and standing conferences associated with the oil industry contributed to the survey.

The Council of Science and Technology Institutes proposed the setting-up of a framework of occupational qualifications last June. Subsequent consultations show that more than half of universities welcome the idea. Most of the others have not responded. More than 70 top industrial companies, many major employers of science graduates and large investors in leading-edge research, have also give support, claims the council.

There are, as the report indicates, a number of important caveats including: the need for clear focus to its work; a purposeful and non-bureaucratic style; a small, influential and effective governing council; and care in avoiding overlap and duplication of effort with lead bodies in associated sectors.

For universities, new courses leading to an NVQ could help in attracting students, said Alastair Robertson, who will be overseeing the initiative for the Department of Employment. 'In those courses that are highly practice-orientated rather than academic students may be able to earn brownie points towards an NVQ. Universities may end up re-inventing the old sandwich courses,' he said.

He added that there was no intention that NVQs should replace degrees. Plenty of diplomacy would be needed to link them up with existing qualifications that have similar goals.

Some NVQ courses are already being developed. The first two will probably be analytical chemistry and forensic science, being developed with the Royal Society of Chemistry.

New bursaries for 'top flight' engineering students

Nearly 3,500 schools and further education colleges throughout the United Kingdom have received details of a new initiative to encourage high-achieving students to take up accredited engineering degree courses.

The Top Flight bursary scheme will provide suitably qualified students with £500 per year in addition to their maintenance grants for the duration of their undergraduate courses.

Students embarking on engineering courses in the autumn of 1994, 1995 and 1996 will be eligible to apply for the bursaries, providing they have A-level grades of at least AAB or SCE Higher grade, five subjects at grade A or equivalent..

Application forms will be made available from Autumn 1994 in all UK further and higher education institutions offering accredited engineering degree courses which may be sandwich or part-time as well as full-time.

Altogether £10 million has been provided by the Department for Education for the bursaries.

Details of the scheme are contained in a leaflet available from The Engineering Council, which will administer the scheme. Copies of the leaflet have been sent to public sector schools, further education colleges and independent schools.

Both the government and the Engineering Council hope that these awards will make an important contribution towards attracting young people to engineering as a career.



Mr Graham D McLaren (centre) receiving the Institute of Petroleum Prize Certificate for being the Best Performing Student on the Robert Gordon University Linked Postgraduate Diploma/MSc in Offshore Engineering Course for the 1992/93 session. Mr McLaren also received a cheque. Both were presented on behalf of the Institute by council member Mr KJ Fleming (left) who is also Deputy Chairman and founder of the Aberdeen Branch. Dr WE Mason (right), Senior Lecturer and Course Leader at the School of Mechanical and Offshore Engineering of the Robert Gordon University, looks on.

New IP careers brochure

The IP career information brochure on the petroleum industry for young people has recently been completely revised and restyled. The Institute, with the co-operation of oil companies, has prepared a 20-page full colour new edition of 'Careers in Oil'. It includes basic information about the petroleum industry and profiles of 28 young graduate entrants working for oil and gas companies. Examples from jobs in all sectors in the industry – exploration, production, refining and manufacturing, marketing and distribution, research and development and commercial services – are given together with comments on their experiences from the young entrants.

The brochure has been prepared for students in the 14-17 year old range when they are considering the next steps in full-time education. It lists the subjects the profilees studied in their final year at school as well as at university. These lists show that the oil industry considers students who have studied a wide range of subjects but inevitably the emphasis is on those who have studied science or engineering.

The brochure has been distributed to all Heads of Science and Careers Teachers at all UK secondary schools as well as universities, further education colleges and careers offices. Further copies are available through the IP Information Service.

The Institute has also recently augmented the number of simple two-sided A4 information sheets giving information on opportunities in the oil industry for students studying a specific range of subjects. In addition to the already available 'overview' sheet, three new sheets for 'engineering students', for 'arts and social science students' and for 'mathematicians and science students' are also being distributed to schools and colleges. These sheets are also distributed at career fairs and sent out by the IP Information Service in answer to enquiries from young people for information on the oil industry.

ELF goes green with Ecotech coatings

Elf Oil UK is one of the first companies in Britain to use the new environmentally-sensitive systems from International Protective Coatings' Ecotech.

Two storage tanks at Elf's Milford Haven refinery, each 12 metres high and over 29 metres in diameter, were repainted as part of the company's maintenance programme. Elf chose two of the new generation of coatings, developed as part of the Ecotech initiative in line with their corporate environmental policy.

Both tanks needed a high-performance coating to ensure long-lasting protection. Interplus 256, a high-build aluminium epoxy primer, was used to 'wet out' rust-affected areas of the steel substrate. It contains aluminium pigmentation, designed to provide 'excellent' anti-corrosive proper-

ties. With its high solids content, it is well within European requirements and exceeds the current stringent US environmental regulations regarding the VOC levels.

Once the application of the surface primer was complete, the tanks were then coated with Intercryl one pack water-borne acrylic - the 520 anti-corrosive primer finish and the 700 semi-gloss finish. The 700 was applied for added protection and the attractive decorative appearance it provides, a particular advantage at Milford Haven as the tanks are situated on the fringe of Pembrokeshire National Parks.

The low odour and quick-drying properties of the products make them extremely user-friendly.

'The salt-laden environment on the southwest coast of Wales is probably

one of the toughest in Britain', according to Mr Brian Taylor of Elf. 'By developing the Ecotech range, International Paint has moved forward into the 21st century, a step ahead

of forthcoming legislation.'

The Ecotech initiative was introduced by International Protective Coatings to help specifiers select safer and more environmentally-sensitive coatings.



Before and after at Milford Haven



Managing chemicals and flammable liquids

ARCO has introduced a range of containers designed to help to ensure employees' safety by providing for the safe storage, transportation, use and disposal of flammable, toxic, corrosive or noxious liquids.

The safety storage cabinets comply with current legislation and have been developed for use in any workplace. In sizes from 610 x 610 x 306mm to 1830 x 915 x 438mm, there are three styles of cabinet: one for the safe storage of flammable liquids, another for acids and a third for pesticides and agrochemicals. Completing the range of storage products, ARCO's round and oval terne plate cans in capacities of 0.48 - 18.5 litres feature wide nozzles for fast easy filling and emptying, flash arresters, automatic pressure relief valves and leak-proof caps which all help in the prevention of accidents.

For the safe transportation of liquids, the company provides Winchester bottles and a zinc-coated steel carrying box with an opening lid that allows liquids to be dispensed straight from the container.



Oily waste can

ARCO's safety dispensing, plunger and bench cans together with dip tanks incorporate features designed to give greater control over the volumes of liquid dispensed at any one time. This not only reduces the risks associated with the escape of noxious, potentially-flammable vapour but prevents evaporation loss. All are manufactured from corrosive-resistant terne plate, and the cans have integral metal flash arresters to prevent the ignition of contents.

The final stage in the management process is the safe disposal of the liquids and any cloths or other materials that have been soaked in them. A selection of purpose-designed waste bins and oily waste cans designed to guard against spontaneous combustion are also available, together with terne plate liquid disposal cans.

Common standard for software

Hewlett-Packard's new application-programming interface (API) to the Petrotechnical Open Software Corporation (POSC) is designed to give the petroleum industry a common standard for integrating independently developed software.

The POSC API is expected to help petroleum companies reduce the risks involved in oil and gas exploration through better sharing and management of information.

'Companies could soon save upwards of tens of millions of dollars by choosing plug-and-play software that leverages existing information and products,' said Mr Douglas Dedo, Marketing Manager for OpenODB. 'Without the POSC API, trying to integrate diverse software applications can cost twice as much as the software itself.'

Tank monitoring offers auto calibration

A new monitoring system for fuel storage tanks, known as the AutoStik II, is now available through Hockman-Lewis Ltd.

The system monitors the new multiple thermistor digital probes and current AutoStik probes and its modular design offers many new features and options for field expansion and system upgrading possibilities, according to the distributor.

Easy to programme and



menu-driven, the system can generate up to eight custom tank charts, while the addition of multiples of eight tank probes and sixteen contact inputs 'is as simple as

plugging in an additional printed circuit board'. The unit includes a thermal printer for on-site reports, and has remote monitoring and programming potential.

The optional auto calibration feature develops an actual representation of the storage tank and its volumetric characteristics, greatly decreasing the possibility of false or inaccurate leak detection results. It generates reconciled inventory/status reports.

Software controls provers

In a related development programme to its fiscal coriolis metering work, Malton North Yorkshire-based Spectra-Tek is shortly to release derivative software for its Sentinel 500 flow computer to enable it to control a Fisher Rosemount Brooks Compact Prover, as well as conventional provers.

This facility can be retrofitted to all extended Sentinel 500 systems and is the first major enhancement to be released since the launch of the flow computer in 1992.

Commenting on the announcement, Mr Stephen Coulson, the company's sales manager, said: 'The 500 was designed from the start to be easily reconfigured in the field, removing a client's dependency on Spectra-Tek for changes and dramatically reducing the whole life-cycle cost of the product.'

'We expect to be supporting these systems for a very long time. It is worth remembering that our first microprocessor-based flow computer, which was also a world first, was installed in the early 1970s and has only just been recommissioned.'

The first application of the new facility was recently undertaken on a major North Sea development.

Walking through the inside of a pipe

The internal inspection of four pipelines crossing the Neath River in South Wales using the new Pipewalker Internal Pipeline Vehicle (IPV) has recently been completed by Oceaneering International Services. Each line was approximately 140 metres from access

point to exit. Their diameter sizes ranged from 10, down to six inches. All were 'spares', more than 20 years old and none had ever been inspected.

The object of the survey was to determine if these spare lines were fit to put into service, releasing

existing in-service crossings for further inspection.

The Pipewalker is pneumatically-driven and 'walks' through the inside of flooded or dry lines. It provides colour video and four channel ultrasonic wall thickness measurements.

A particular design feature is its ability to negotiate 1.5D radius bends, so that even tortuous pipe systems can be surveyed. Pipework in the range of 3.5 to 10 inch diameter can be inspected.

The current IPV Pipewalker has a depth limit of 150 feet of seawater and has obvious offshore applications for the internal inspection of oil and gas risers.

Outdoor pay terminals approved

Triscan has gained Weights and Measures approval for its range of Outdoor Payment Terminals interfaced with systems from two more major dispenser manufacturers. The systems, designed for use on petrol forecourts, can now link into Gilbarco and Tokheim equipment.

The fuel island payment terminals, already used by Tesco and Sainsburys at many of their service stations, accept credit and debit cards to allow both 'out-of-hours' fuelling and/or a 'fast lane' facility. This allows customers using plastic to pay at the fuelling point rather than at the kiosk.

An outdoor payment terminal in use



Mapping personnel movements

The Unix version of Logica's Movements and Personnel System (MAPS) has gone into live operation for two North Sea oil field operators, bringing the total number of MAPS sites to seven. The first operator to run the version was Shell UK Exploration and Production for its southern North Sea operation, based at Lowestoft. Soon after, Chevron UK accepted the system for its Alba field and plans to extend it to all its UK sites by the end of the year.

The system was ported to Unix in response to the growing strategic demand for open system solutions. Both Shell Expro, at Lowestoft, and Chevron are running MAPS on Hewlett Packard machines but the system has also been successfully test-ported to Digital Equipment Alpha, IBM RS/6000, Tandem and Sun platforms and can be used on any other open systems-compliant computer.

Lightweight diving chamber meets standard

The SOS 'Hyperlite' Hyperbaric Stretcher is now available in a form that meets the Safety Standard for Pressure Vessels for Human Occupancy.

The stretcher is said to be the only truly portable transport chamber (TUP) that can be pressurised easily on site and then be transferred under pressure to and into virtually any therapeutic facility, without the need for any lock-on device. It can also be used for emergency medical treatment in life-saving situations where therapeutic facilities are not locally available.

The approval of the code case by the American Society of Mechanical Engineers (ASME) represents a major break-

through in chamber design technology, according to SOS. It introduces lightweight composite materials of great strength to an industry hitherto accustomed only to traditional

metallic materials, where weight made portability a significant problem.

When not in use, the stretcher can be folded away into two compact travel cases.



The Hyperlite Hyperbaric stretcher

Specialist cables from ABB

ABB Control is marketing cabling products in the United Kingdom for the first time, including the fourth generation Flex-Flame HCF range of offshore topside cable which is capable of withstanding temperatures of 1,100 °C for up to one hour.

The range covers all topside platform cabling requirements from 250V instrumentation and telecommunication applications up to 10kV emergency power cabling.

The company is offering cabling products for the first time – it used to operate in the low voltage protected component market

It has already secured a major contract with BP, supplying cable throughout the Bruce field development.

Monitoring low carbon monoxide emissions

Servomex has added a new model to its 2510 series of gas filter correlation (GFC) infrared analysers, which is designed to continuously monitor very low levels of carbon monoxide in emissions and product gases.

Employing advanced single beam GFC technology, the analyser uses hermetically-sealed gas cells containing reference and inert gases in place of normal interference filters. They give the benefits of extended sensitivity over a

wide dynamic range and excellent selectivity with good rejection to cross-interference. A typical measurement range is 0-200vpm with an intrinsic error of ± one percent FSD (full scale display).

The design includes features such as a brushless DC chopper motor to give long-term performance with minimum maintenance even under harsh operating conditions and a high tolerance to contamination

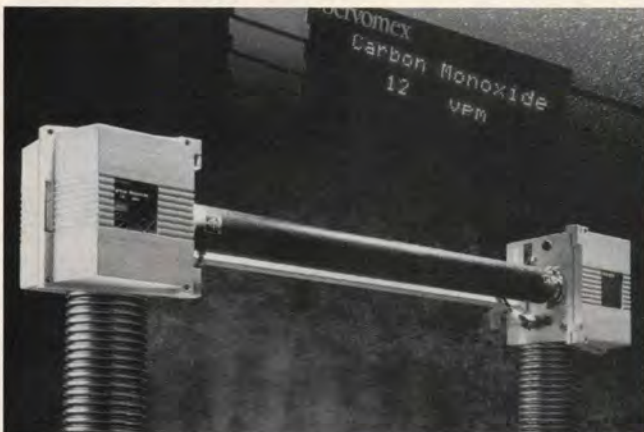
on the sample cell windows. For CO measurements, normal sample conditioning is used to dry the gas and the temperature of the heated cell is set at 60°C.

The control unit for the analyser contains a bright vacuum fluorescent display for clear visibility and a simple keyboard. The system

is menu-driven and designed to be as intuitive as possible, requiring the minimum of operator familiarisation.

This variant of the 2510 analyser can measure carbon monoxide emissions from all types of incinerators, industrial furnaces, boilers and other combustion processes.

Infrared analyser for CO monitoring



CONTACTS

International Protective Coatings	(091) 469 6111
Arco	(0482) 27678
Hewlett-Packard Customer Info Centre	(0344) 369369
Hockman-Lewis	(201) 325 3838
Spectra-Tek	(0653) 695551
Oceaneering International Services	(0224) 770444
Triscan	(0254) 682111
Logica Industry	(071) 637 9111
SOS	(081) 959 4517
ABB Control	(0203) 368500
Servomex	(0892) 652181



Conoco Limited has appointed **Mr Terry Indreland**, above, as Director and General Manager of its Humber refinery at South Killingholme, Humberside. He succeeds **Mr Alan Hodson** who is retiring after 25 years. Mr. Indreland will also be responsible for Conoco's European refining strategy.

Mr Heinz C Rothermund is to be proposed to the board of Shell UK Limited to succeed **Dr Chris Fay** as a Director, and as Managing Director of Shell UK Exploration and Production. Dr Fay has been appointed Chairman and Chief Executive of Shell UK Ltd.



Mr Loik Le Floch-Prigent, above, has been appointed Chairman of the Board of Gaz de France. He succeeds French Ambassador **Mr Francis Gutmann** who has been appointed as Honorary Chairman.

Mr Ernest Thompson, Director of Sales of Ford in Britain since 1986 has been appointed by the Society of

Motor Manufacturers and Traders as Chief Executive.

Mr David Denton, below, currently Managing Director of ABB Industry Ltd, will move to Stevenage to become Managing Director of the newly formed ABB Industrial Systems Ltd, while **Mr John Trostheim** transfers from his present position of Managing Director of ABB Process Automation Ltd, to President of ABB Industrial Systems Inc based in Columbus, Ohio.



Mr Nader Sultan is to leave the chairmanship of the London-based Kuwait Petroleum International to become Deputy Chairman of Kuwait Petroleum Corporation, which manages the Gulf state's oil exploration, production, refining and transportation.

Total Oil Marine has announced several management changes. **Mr Dominique Chauvin** has been appointed Manager of Joint Ventures. He succeeds **Mr Timothy Forbes** who has become business manager for TOTAL Thailand. **Mr Jean Gostoli** has been appointed Exploration and Appraisal Manager, succeeding **Mr Bill Wheatley** who has taken up an appointment with TOTAL Exploration and Production in Paris. Following the relocation of TOTAL's Head Office to Aberdeen, the Operations Division has been reorganised. **Mr Ian Dundas** has been appointed Production

Manager. **Mr Simon Cane** has been appointed Operations Controller. **Mr David Henson** has been appointed Safety and Environmental Manager, succeeding **Mr Charles Bowen** who has moved to TOTAL Group Headquarters. **Mr Christian Pech** has been appointed Manager of the TOTAL operated terminal at St Fergus and **Mr Jean-Claude Nawrot** has been appointed Drilling and Marine Manager succeeding **Mr David Young** who has retired.



Mobil North Sea Limited have appointed **Mr Lance Johnson**, above, as President and General Manager. He succeeds **Mr Bob White** who has been appointed President of Mobil's Dallas-based US exploration and production company.

Mr Dermot Smith, below, has joined Integer Micro Systems Ltd to handle marketing of their TANKERBASE™ computer system.



Davy Press Technology has appointed **Mr Norman Harris** as Director of Research and Development with responsibility for the day-to-day operation of its Research and Development facilities at Stockton-on-Tees.

Mr Alex Wilson has been appointed Head of the new Department of Trade and Industry Oil and Gas Office in Aberdeen where he will take charge of the Aberdeen relocation project.

Mr John Waters has been appointed Managing Director of Groundwater Technology International.

The Shell Group of companies in Singapore has appointed **Mr Peter Chen**, Shell Eastern Petroleum's Finance Director, as Group Chairman and Chief Executive. He succeeds **Mr Robert Walvis** who moves to Japan as Senior Adviser to the board of Showa Shell Sekiyu KK.

Eurosov Petroleum Limited (subsidiary of Vanguard Petroleum Ltd.) have appointed **Mr John Higgins** as Chief Executive of Eurosov Petroleum Limited. Mr Higgins was previously head of Lasmo's Russian Special Projects Department.

Mr Fergus McGhie has joined Stena Offshore Ltd as Marketing Manager. He will have responsibility for marketing in the UK and Europe. He previously worked with Elf Enterprise Caledonia as a subsea operations engineer.

LASMO plc has announced that **Mr Michael Pavia** is to step down as Finance Director. He will remain until the end of the year to effect an orderly transition. A successor has not yet been appointed.

Institute News

Around the Branches

ABERDEEN

14 December: 'Policing the North Sea', Dr Ian Oliver, Chief Constable.

EDINBURGH AND SE SCOTLAND

9 December: 'Advances in Pipeline Design', Mr G T Harker, BP Engineering, Heriot-Watt University.

MALTA

17 December: Christmas Function.

1994

ABERDEEN

11 January: 1993 Offshore Technology Winner.

8 February: AGM.

EDINBURGH AND SE SCOTLAND

13 January: AGM and Video presentation. BP Oil Refinery, Grangemouth.

10 February: 'The Piper Bravo Project', Mr K Dillon, Elf.

Enterprise Caledonian. Fourth River Purification Board, Riccarton

ESSEX

12 January: 'The Removal of Sub-Surface Pollution' by G Licence of Miller Environmental Limited.

9 February: 'On-line Engineering by C Smith of Furmanite Engineering Ltd.

HUMBER

20 January: 'Tanker Quality and Shipping Inspection'. Speaker: Captain G Vanden Bergh.

LONDON

18 January: 'Virtual Reality - Its Potential for Business Application', M Thornton & A Tait, Dimension International.

MALTA

25-27 January: 'MOEX 94'.

MIDLANDS

12 January: 'A Presentation by Gulf Oil Ltd at Gulf Oil (GB) Limited.

NORTH-EAST

25 January: 'Solving On-line Problems in Process Plant', speaker from Furmanite Limited.

NORTHERN

18 January: 'New Engines & Lubricant Requirements', by J Hillier - consultant

SHETLAND

15 February: AGM.

SOUTH WALES

18 January Visit

STANLOW - 1994

19 January: AGM. 'The British Coal Liquefaction Process'.

Award of IP Certificate of Appreciation



Dr Bryan Hayton (right) presents Mr J M Nicholas with the IP Certificate of Appreciation

J M Nicholas first became a full member of the IP Bitumen committee in 1964. He was appointed as deputy chairman in 1966 and continued in this office until 1976 when he was appointed chairman. This caused quite a stir as he did not work for one of the oil companies and a ruling had to be obtained from Council on this matter. On his retirement from the Road Research Laboratory in 1978 he relinquished the post of chairman but remained a member of the committee until he finally retired in 1993.

'Nick' was one of the UK's leading experts on bitumen test methodology and his depth of knowledge, coupled with his practical experience and common sense approach, made him a very able chairman and a valuable member of the committee.

UK Deliveries into Consumption (tonnes)

Products	†Sep 1992	*Sep 1993	†Jan-Sep 1992	*Jan-Sep 1993	% Change
Naphtha/LDF	286,254.0	145,366.0	2,479,828.0	2,260,367.0	-9
ATF - Kerosene	621,286.0	658,461.0	5,145,639.0	5,361,029.0	4
Petrol	2,026,304.0	1,926,586.0	17,894,284.0	17,298,755.0	-3
of which unleaded	974,310.0	1,035,229.0	8,254,379.0	9,005,618.0	9
of which Super unleaded	124,932.0	120,797.0	1,042,878.0	1,067,651.0	2
Premium unleaded	849,378.0	914,432.0	7,211,501.0	7,937,967.0	10
Burning Oil	217,415.0	224,124.0	1,714,860.0	1,810,052.0	6
Derv Fuel	983,814.0	1,017,710.0	8,223,278.0	8,680,009.0	6
Gas/Diesel Oil	650,416.0	656,832.0	5,768,338.0	5,641,273.0	-2
Fuel Oil	808,508.0	911,532.0	8,234,275.0	7,849,368.0	-5
Lubricating Oil	68,709.0	64,844.0	580,157.0	572,488.0	-1
Other Products	636,849.0	606,660.0	5,213,617.0	5,448,270.0	5
Total above	6,299,555.0	6,212,115.0	55,254,276.0	54,921,611.0	-1
Refinery Consumption	509,633.0	523,546.0	4,523,502.0	4,704,164.0	4
Total all products	6,809,188.0	6,735,661.0	59,777,778.0	59,625,775.0	0

† Revised with adjustments *Preliminary

Institute News

New Members

Mr A O Adeshina, 77 Redington Road, Hampstead, London NW3 7RR
Mr G J Bishop, Shell International Petroleum Co Ltd., Shell Centre, London SE1 7NA
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Mr E Recalde, Bureau Veritas, Hungria 324 Y Mariana De Jesus, PO Box

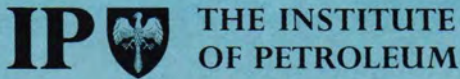
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Student Prize Winner

Mr M S Ridgway, 2 Berryhill Place, Newtonhill, Stonehaven, Kincardineshire AB3 2QZ



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