PETROLEUM REVIEW

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May 1995

Refining
Refining the fuels of the future

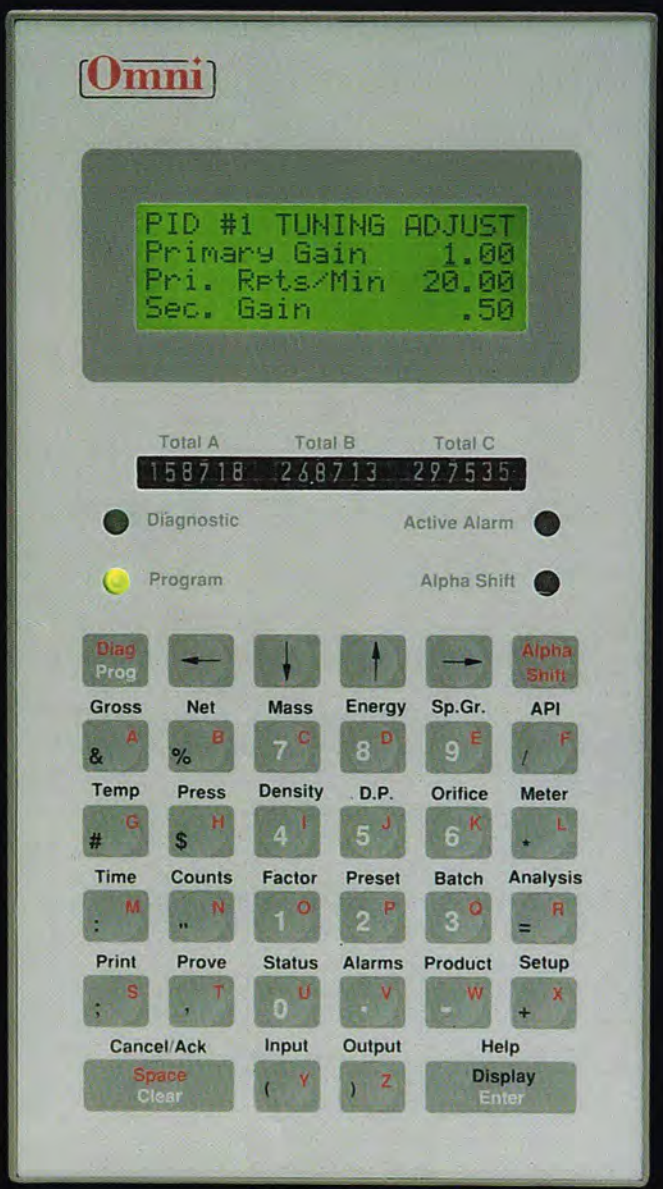
United States
Reverberations from clean fuel mandates

South Africa
Pik Botha addresses branch dinner

Vietnam
Towards an integrated petroleum industry

Q: Which flow computer is best for liquid and gas measurement and control?

A: Omni . . . the *only* answer.



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COVER PHOTO
Lindsey oil refinery, South Humberside

NEWS IN BRIEF

23 March

Chevron and the NNPC reached a milestone in the development of the Nigerian Escravos gas project, with the award of contracts totalling $320m for the construction of facilities to gather and distribute the gas.

Chevron plans to double its output from the Tengiz field in Kazakhstan to 100,000 b/d by the end of 1995, according to planning manager Jim McCabe.

Allseas Marine Contractors has clinched the £13m engineering, procurement, fabrication and installation contract for the Schooner development in the southern North Sea.

Kvaerner and Stolt Comex Seaway have forged a strategic alliance, offering fabrication and installation of complete subsea oil and gas production systems.

OPEC is ignoring its production ceiling of 24.52m b/d, according to the *Middle East Economic Survey*. February output was some 500,000 b/d above quota.

24 March

Over 100 insurers involved in the *Exxon Valdez* disaster have won a major legal battle in their fight against loss coverage. The multi-national group of insurers claims it is not liable for all the losses because the spill resulted from Exxon's own neligence in retaining Mr Joseph Hazelwood as master. Their suit against the company has now been re-instated by a New York federal appeals panel.

25 March

An electrician carrying out routine maintenance work on Marathon's North Sea Brae B platform suffered burns to his hands and face in a flash electrical fire. The platform was shut down for most of the day.

26 March

Statoil has announced a 'promising discovery' in Norwegian block 34/10, west of the Gullfaks field.

27 March

Output on Statoil's Gullfaks field has fallen below target as a result of drilling delays and bad weather.

British Gas has been forced to re-route a planned pipeline in the Irish Sea in order to steer clear of 25,000 tonnes of deadly chemical weapons dumped during the 1950s.

The National Response Corporation has introduced a new low-cost pollution response cover for cargo vessels, cruise-ships and containerships.

Jordan is to form a $29m national oil company, with the aim of increasing the country's natural gas output for electricity generation.

A new set of guidelines for UK offshore support vessels has been produced by the industry. The 70 member companies of UKOOA, BROA and the IADC have agreed to charter only those vessels which meet these standards.

Britain has backed attempts by the EC to open up the energy markets of five member states to competition. The Commission has accused France, Italy, Spain, the Netherlands and Ireland of allowing monopolies in electricity and gas.

Up to eight applications have been made for some individual blocks west of Shetland in Britain's 16th Round of offshore licensing. In all, applications were received for half the total number of blocks offered.

28 March

The Prudential, the largest investor in British Gas, has warned the company that it must deliver a higher performance if it is to justify the 75 percent pay rise recently awarded to Chief Executive Cedric Brown.

The United States called for a world-wide embargo on Libyan oil in order to force Colonel Gadaffi to hand over the two Libyan intelligence officers accused of planting the 1988 Lockerbie bomb. America's European allies reacted cautiously to the surprise announcement.

The merger between Caltex and Ampol, which will create a market leader in petroleum refining and marketing in Australia, has been give the go-ahead by the country's Trade Practices Commission.

29 March

For the first time in over five years, Trinidad and Tobago is inviting foreign bids for offshore exploration. Nearly 500,000 hectares are on offer.

Shell has announced a radical re-structuring of its service companies, designed to make the organisation 'simpler, more flexible, more responsive to the customer and less costly'.

30 March

Ireland plans to become an offshore oil producer by 1996, according to Aran Energy Chairman Michael Whelan. New technology, the halving of Irish exploration tax and more flexible forms of financing are all helping to make offshore drilling feasible.

31 March

Production from two North Sea gas fields, Esmond and Gordon, has ended. BHP announced that the wells are to be shut in and the installations decommissioned prior to their removal. Heeremac will carry out the removal work.

BP Oil Europe has formed a joint venture with state-owned LPG company, Korgaz, to serve the Poznan region of Poland. BP plans to invest $10m in the new company.

1 April

Two Amec employees were airlifted to hospital after being injured on Mobil's North Sea Bravo platform. One of the men suffered head and leg injuries after an incident in a pipe well.

2 April

Saudi Aramco is planning a major expansion of its national production from 7.9m b/d to over 9m b/d, according to the Arabic newspaper *Al Hayat*. The boost in output, which will cost the company $6bn, will come from four fields: Harad 1, Harad 2, Na'im and Sheba.

3 April

Mobil has finalised the sale of its Dutch offshore exploration and producing operations to Clyde Petroleum.

An Iraqi oil tanker that sank close to the port of al-Bakr during the Gulf War is now believed to be in danger of shedding its load. A Kuwaiti-based environmental body has warned that the tanker, which contains 100,000 tonnes of crude oil, is threatening an 'environmental catastrophe'.

India has toughened up its pollution laws, making it mandatory for all new cars sold in the country's major cities to be fitted with catalytic converters. Parking charges have also been increased.

Norwegian North Sea drilling contractors, Transocean and Wilrig, have unveiled merger plans which would create the world's third largest semi-submersible drilling company.

Rosneft is to be transformed into a joint stock company, according to the Russian government. The state will retain a 51 percent stake for the first three years but then remaining shares may be sold on the stock market.

Two new sets of offshore safety legislation have been laid before the British Parliament. The Offshore Installations (Prevention of Fire and Explosion and Emergency Response) Regulations 1995 and the Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995 will come into effect on 20 June.

4 April

Chevron is to axe 20 percent of its workforce in Canada because of declining rates of return.

A $150m crude oil terminal is to be built in southern China by a joint venture led by Sinopec Guangzhou Petrochemical Complex. The terminal will be the second for large tankers in the area.

Oil shipments were temporarily suspended at the Black Sea port of Novorossisk after an explosion took place at an oil products facility.

BHP has confirmed it is carrying out an environmental impact study for a 700km gas pipeline from Victoria to Sydney, in New South Wales. A final decision on the feasibility of the project will be made in mid-1996 and the pipeline could then be in operation by 1997.

NEWS IN BRIEF

European Marine Contractors, which is jointly owned by Brown & Root and Saipem, has won a fast-track contract from BP to replace the pipeline running between the Alpha and Charlie platforms in the North Sea Forties field.

Denmark has announced plans to grant nine new exploration licences for oil and natural gas in the Danish sector of the North Sea. This will involve investments from oil companies of up to DKK1.3bn.

5 April
Total is moving further and further upstream, according to Group Chairman Serge Tchuruk. The company projects that 60 percent of its earnings will come from upstream oil and gas operations by the year 2000.

Applications for licences to explore around the Isle of Man have been received from 11 international conglomerates involved in five groups. The applications cover half the blocks on offer in the island's first offshore licensing round, the results of which will be known in the summer.

Amoco is to drill a new exploration well West of Shetland in the Tranche 4 area.

6 April
Petroleos Mexicanos is planning its first major oil expansion programme in years. Energy Minister Ignacio Pichardo said output will be increased by 100,000 b/d towards the end of the year, bringing in up to $400m in extra earnings this year and up to $1.9bn in 1996.

The European Court of Justice has thrown out fines imposed by the EC on ICI, Shell and 15 other chemical companies, for allegedly running a cartel in low-density polyethylene. The court ruled that the Commission failed to follow internal procedures when deciding the fines, which totalled 37m ECU.

A consortium consisting of Victoria Oilfield Development, Diamond Offshore and Halliburton has been awarded the contract for carrying out an extended well test in the West of Shetland Schiehallion field.

7 April
Speaker of the Ukrainian parliament, Oleksandr Moroz, warned that Gazprom was on the verge of cutting off gas supplies to the Ukraine. Gazprom later denied the allegation.

The British Gas share price increased by around five percent in just two days following City rumours that the Hanson group was considering a takeover bid.

Elf has called for the formation of a group of independent experts to oversee fuel rules in the Formula One World Championship. The company also insisted it complied totally with fuel regulations in the Brazilian Grand Prix, despite the disqualification of racing drivers Michael Schumacher and David Coulthard for 'illegal fuels'.

Conservative backbencher Alan Duncan has tabled an amendment to the UK Gas Bill, calling for Transco to be split off from British Gas as a wholly-owned subsidiary.

9 April
The Greek Vardinoyannis group has agreed to sell half its oil business to Saudi Aramco. Aramco will now be an equal partner in both Motoroil Hellas, which controls the country's largest private refinery, and in the petrol station and lubricants company, Avin.

10 April
British Coal's petrol-from-coal plant at Point of Ayr, in North Wales, will close unless a new backer can be found. The company announced that financing will run out in May and decommissioning will start in the summer.

Fortune Oil, Vitol and China Aviation Oil Supply Corporation (CAOSC) have announced a $250m joint venture to supply aviation fuel to 14 airports in central and southern China. CAOSC will hold a 51 percent interest in the project, while the two foreign companies will each have a 24.5 percent stake.

Attempts are being made to export two oil rigs from Iran to Serbia, according to the *New York Times*. The rig parts are believed to have been split up into over 100 lorries, which are currently moving through eastern Europe.

British Gas has signed a contract with First Philippine Industrial Corporation to inspect nearly 120km of white oil pipeline.

An experimental three-month ban on traffic in the shopping and business centre of Athens began today. The ban covers almost all vehicles, allowing only minibuses, residents' cars and a few taxis into the square-mile area.

11 April
Enterprise Oil has announced the successful conclusion of a testing programme on the Doina-2 exploration well, offshore Romania.

The placement of shares in Repsol has been two and a half times oversubscribed, according to the company. Describing the sale as 'a great success', Chairman Oscar Fanjul set a price of Pta3,448 for retail investors and Pta3,620 for institutions.

McDermott Marine Construction has been awarded a £40m subsea flowline contract by Shell UK, for the FPSO development of the central North Sea Teal, Teal South and Guillemot fields.

Iran has accused Azerbaijan of caving into US pressure after Baku withdrew its offer to Tehran of a stake in the $7.4bn Caspian Sea venture.

In an attempt to break the deadlock between Russia and Turkey over rival pipeline plans from the Caspian Sea, US Ambassador to Kazakhstan William Courtney suggested that more than one route be built.

12 April
Azerbaijan and Turkey have finally signed the deal which increases Ankara's stake in the Caspian Sea venture to 6.75 percent.

The price of Brent Blend for May almost reached $19 a barrel, hitting a high of $18.97.

13 April
BP has scrapped free share option plans for its top executives in favour of a three-year rolling performance arrangement but has retained the controversial scheme for middle management.

Shell UK has inflamed fears over the future of Sullom Voe by admitting that it is considering switching to offshore loading on the Brent field at the turn of the century.

14 April
The *Washington Post* has alleged that seven major US oil companies underpaid royalties to the federal goverment to the tune of $29.5m between 1990 and 1993. The paper also accused the Interior Department Agency of doing little towards re-claiming the debt.

15 April
British Gas has cut prices for its interruptible customers by between 16 and 22 percent.

16 April
Neste and Kvaerner have teamed up with several Russian organisations to form a joint venture with the aim of developing energy resources in the Russian Arctic.

Conoco has denied laying on a luxury, five-star weekend for Labour leaders Tony Blair and John Prescott at Gleaneagles in Scotland. Both men were attending a demanding working seminar on energy and the only 'perks' involved were meals, according to the company.

18 April
Mobil has agreed to establish a joint venture with Kazakhstan which will invest at least $80m in exploring the western Atyrau and northwestern Aktyubinsk areas over a five-year period.

19 April
Citizen's Charter Minister David Hunt has ordered British Gas to improve its standards of service by the end of the year or face losing its charter mark.

Cairn Energy has revealed plans to launch a £17.8m bid for Holland Sea Search Holding.

Egyptian oil minister Hamdi el-Banbi has launched a $106m scheme to develop natural gas off the Mediterranean coast.

20 April
The German companies, Ferrostaal and Helm, have teamed up with two Trinidadian companies to build a $250m methanol plant, the fourth to be constructed in Trinidad.

WANTED: downstream partner for Elf UK

Elf is 'aggressively seeking to boost its share of the UK retail network', with a major two-pronged attack on the market.

The company confirmed it is searching for a retail partnership in Britain, in order to secure at least five percent of the market. At present, Elf's share stands at just under four percent with around 650 stations nationwide.

An Elf spokesman said the aim was to have a partnership agreement in place by the end of the year and stressed that the company was open to offers from all sectors of the petrol retail market, including the hypermarkets.

At the same time, Elf has launched a major new initiative to attract dealers.

'"Formula Elf" has two main plus points,' said the spokesman. 'It allows dealers to retain their independence, but it also frees them from putting up large amounts of working capital.'

Under the new package, Elf retains ownership of the fuel.

Elf aims to secure at least five percent of the UK retail market

The dealer derives his or her profit from an operating allowance and a commission on fuel sales. 'This leaves them to concentrate on the main part of their business, which is boosting sales on the forecourt and at the shop.'

Elf believes its package is a first. 'The freeing up of capital is very new,' said the spokesman. 'No other company provides that.'

Elf has admitted that a complete withdrawal from the UK retail sector is one possibility for the future, but only if all attempts to secure a larger share of the market fail. 'Pulling out would only be an option in the very longterm,' according to the spokesman. 'Our goal at the moment is most definitely to make the business grow.'

Independents fear British Gas coup d'etat

Independent gas suppliers hoping to move into the UK domestic gas market once it is opened up to competition are deeply concerned that British Gas may scupper the whole liberalisation process by dropping their prices at the 11th hour.

'This is the number one concern amongst the shippers at present,' one major independent told *Petroleum Review*. 'And we believe there is a 50:50 chance that this particular scenario will take place.'

The independents want to see a market share target introduced into the Gas Bill. This could work in a similar fashion to the quota which was woven into the UK's commercial and industrial sector when that part of the market was opened up to competition.

This stipulated that British Gas shed at least 45 percent of its industrial business by 1995 and indeed that target was reached a year ahead of schedule.

Without a similar type of constraint in the domestic sector, some independent shippers fear that British Gas will be free to pull the carpet from under their feet. 'If British Gas dropped its prices by, say, 10 percent at the end of 1997, where would that leave the rest of us?', asked one shipper.

'A quota target is a vital safeguard, without which the ball is completely in British Gas's court.'

Some independents also believe they may end up paying over the odds to cover social obligations, under the current draft proposals. 'We're looking at a double whammy', according to one industry source. 'Transco has been given the right to impose a transportation levy in order to cover the cost of "problem customers", yet we're already obliged to serve all customers within a designated area.'

A third worry amongst certain independents concerns the Network Code. They believe some of the larger shippers are actually frustrating attempts to move forward with the Code, which is an essential prerequisite to the opening-up of the domestic gas market.

Due to go live this October, the Code will define the rights and responsibilities of all participants in the gas transportation industry. However, according to one industry source, 'certain shippers are more than happy with their current terms and conditions and are not keen to disrupt the status quo.'

A spokesman for British Gas firmly dismissed the notion that the company would cut its prices immediately prior to the introduction of competition. 'To avoid discriminating against any of our customers, we would have to cut prices right across the board, which would be fantastically expensive.

'Perhaps rather more importantly,' he added, 'we wouldn't do it even if we could. British Gas wants to see competition introduced on a fair basis and we would far rather be regulated by the market-place than by a regulator.'

UK Retail Marketing Survey

Subsequent investigations following the publication of the IP's 1995 UK Retail Marketing Survey have revealed that the figures regarding vapour recovery could be misleading.

Further detailed analysis has shown that fewer than 10 outlets have Stage II vapour recovery systems that are currently operational. The majority of outlets quoted in our survey (a total of 128) have merely made provisions for Stage II.

Correction

In last month's article on Tesco's latest grade of unleaded petrol, *Petroleum Review* indicated that Transport Secretary Dr Brian Mawhinney had attended the launch of the new product. In fact, due to a last minute change in arrangements, it was Mr Steven Norris MP, Parliamentary Under-Secretary of State at the Department of Transport, who eventually sampled the new supermarket fuel.

'Most Ogoni oil spills caused by sabotage'

Most of the oil spills that took place in the Ogoni region of the Niger Delta in the years leading up to Shell's withdrawal were the result of deliberate sabotage by the local inhabitants, according to the company.

'Investigations show,' said the Shell Petroleum Development Company (SPDC), 'that 69 percent of all spills between 1985 and the start of 1993 were caused deliberately by the communities'. SPDC claims the sabotage was carried out in order to win compensation and make political gains.

While accepting that ageing facilities are one of the main causes of oil spills across the Niger Delta, Shell insists it now has a comprehensive programme of continuous environmental improvement and points to the fact that over $100 million will be spent to this end in 1995.

However, the company does acknowledge that industry treats Third World countries differently from the developed world. 'A country with a population largely without electricity, sanitation and running water will have different priorities to one well endowed with basic amenities and with large resources to devote to further environmental improvements. Companies operating in these settings will be similarly affected.'

The SPDC said it wished Mr Ken Saro-Wiwa (detained for his alleged involvement in the murder of four Ogoni leaders) 'to be correctly treated'. However, the company rejected any suggestion that it should intervene to obtain his release.

Wytch Farm wins Queen's Award

BP has won the 1995 Queen's Award for Environmental Achievement for its extended reach drilling programme at Wytch Farm, in Dorset.

The company was congratulated for pushing the techniques of extended reach drilling to new record-breaking limits, at angles of up to 90°. 'A number of adverse factors had to be overcome,' said the Award Office.

Adriatic pipeline re-opens

The old Adriatic gas pipeline, which runs north through Slovenia, Hungary, the Czech Republic and other countries before finally connecting with the Russian pipeline, has been re-opened.

According to Croatia's Deputy Minister of Finance, the pipeline has finally been repaired after closing during the Bosnian war. The Serbian section, however, is still out of bounds.

Croatia has the demand and resources for an active petrochemical industry but needs company and plant modernisation to exploit raw materials. Last year, the petrochemical industry exported $606 million worth of products but imported $629 million worth.

High hopes for Timor Gap

High hopes for the future oil potential of the Timor Gap, jointly administered by Indonesia and Australia, have been raised by the Elang partners.

The newest offshore oil province has reported two major discoveries within the boundaries of the Zone of Co-operation (ZOC) and one outside. The discoveries have involved BHP Petroleum, Woodside Petroleum, Shell Chevron and Phillips Petroleum.

Woodside's Laminaria discovery, just outside the southwest boundary of the ZOC, is believed to hold 200 million barrels and is the largest find in the area.

Inside the ZOC, a BHP-led consortium last year made its Elang 1 and Elang 2 discoveries. Elang West is currently estimated at 20 million barrels, but added to the estimated 80 million barrels of Elang 2, the whole field becomes a viable operation for FPSO.

Other discoveries in the area include BHP's Katatua-1 hydrocarbon showing and Phillips Petroleum Bayu-1 gas/condensate find 30km southwest of Elang.

If any field in the ZOC goes into production, under the Timor Treaty between Indonesia and Australia, up to 70 percent of production revenue goes to the governments. In the initial stages there are clauses for the companies to recoup costs.

New Russian investment in oil

A new investment bank, which will have a major focus on oil and gas in the former Soviet Union, is to be established in Moscow.

United City Bank, which currently operates as a small Russian commercial bank, will have paid-in capital of $20 million and expects to employ a staff of 60.The bank is a joint venture between MC European Capital and Sintez Corporation.

Mr Stephen O'Sullivan, who will head the oil and gas section of the new venture, said: 'We are expanding at a time when other investment banks are scaling back their activities in the region.'.

Fancy a break from oil?

Oil industry executives are being invited to take a break from the petroleum industry and apply their vital skills to the Third World.

Explorer Colonel John Blashford-Snell, who was responsible for founding Operation Raleigh, is looking for adventurous personnel to join him on project-based expeditions to remote parts of the world.

'Participants could find themselves riding in the mountains of Mongolia, plotting the movement of snow leopards at night with image intensifiers, tracking cheetah through wild country in Zimbabwe, or helping to set up medical clinics in Amerindian villages deep in the rainforests of Guyana,' according to Col. Snell.

Projects are usually for a minimum of three weeks and are suitable for a range of ages – from 25 to 65.

'We have people joining us on sabbatical leave, as an opportunity to refocus their objectives or simply to get a million miles away from their desks,' added Col. Snell. 'But all will be making a constructive contribution.'

Riding in the mountains of Mongolia

'The Interconnector will never reach full capacity'

The UK-Belgium gas Interconnector will never reach full capacity as an export line, according to Wood Mackenzie Consultants.

The driving force behind the £440 million cross-channel pipeline, which will have a capacity of 20 billion cubic metres (BCM), is the tantalising prospect of exploiting future shortfalls in the European gas market. Yet, in a new report, Wood Mackenzie estimates that in a decade's time the gas shortfall in Europe could be as low as four BCM.

The oil and gas consultancy accepts that demand for gas will grow markedly across Europe over the next 10 years, but argues that contracts to supply most of this demand have already been signed. As a result, the report forecasts a gas shortfall in western Europe of just one BCM in 2000. By 2005, demand could be anywhere between four and 16 BCM. The exact amount will depend upon whether contracts with existing suppliers are extended or increased.

Even if there is a market for extra gas, Wood MacKenzie doubts whether Britain can compete with other European suppliers at current beach prices. The fact that there is currently no onward pipeline for UK gas once it reaches Zeebrugge is highlighted as another major obstacle to Britain's export prospects.

WoodMac analysts also doubt whether Britain has the capacity to supply Europe with gas on any scale. 'We not believe,' say the authors, 'that the UK can offer long-term contracts to the European market....In the period post-2005 we believe that Britain will become a net importer of gas.'

One alternative would be to export Interconnector gas to the markets of central Europe. Although heavily dependent upon imports from the former Soviet Union at present, these countries are keen to diversify their sources of supply. However, there is currently no route by which UK gas can reach central Europe.

Chevron slams US oxygenates ruling

A top Chevron executive has condemned the vehicle fuels policy of the United States, describing it as 'a tangle of compromises, special-interest agendas and misguided philosophies'.

In a surprisingly candid speech, Mr David O'Reilly, Chevron's top refining and marketing executive, said the driving public had been overlooked by the policy-makers and launched a particularly fierce attack upon the increasing use of oxygenates.

'Customers apparently don't realise that they're paying for something which – for most of the year – contributes nothing to meeting clean air standards,' he said. 'I don't know how any of us could be proud of that.'

This was a direct reference to the federal reformulated gasoline (RFG) rule, which requires high percentages of oxygenates all year-round in eight different metropolitan areas. According to Mr O'Reilly, oxygenates have two uses: to reduce carbon monoxide emissions in cities during winter months and to enhance octane in gasoline. They do nothing to reduce summer ozone.

'Unfortunately, some highly creative promotional efforts have convinced the public and a lot of government officials that oxygenates are the primary reason reformulated gasoline is cleaner,' he said.

Calling for a change in the federal Clean Air Act, Mr O'Reilly said that the real legacy of the year-round oxygenate rule was wasted investments in infrastructure, unproductive added costs at the pump, reduced fuel economy, reputation problems for all reformulated gasolines, and dissatisfied customers. *(See p203).*

He called for a greater emphasis upon the 'best gasoline reformulations', such as low-evaporation blends and winter oxygenates, and urged the government to eliminate programmes which 'force alternative fuels and vehicles, such as electric cars, onto the market before they're ready to compete.'

Attacks upon oxygenates are now taking place on both sides of the Atlantic. The UK Petroleum Industry Association recently hit out at an American campaign to encourage the sale of oxygenates in Britain.

'French downstream sector under grave threat'

The French oil refining industry tabled losses of FFr239 million last year, compared with profits of FFr2.2 billion in 1993.

'The French downstream sector is under grave threat,' said Mr Bernard Calvet, chairman of the country's petroleum industry association, Union Francaise des Industries Petrolieres (UFIP).

Pointing the finger at the supermarkets, which year on year have eaten away at the refinery groups' share of the fuel distribution market, UFIP is calling on the government to stamp out unfair competition. Long-standing complaints are that the supermarkets operate a 'loss lead' policy and do not always comply with environmental norms. Last year, the refinery groups had a 51.3 percent share of sales, compared with 44.3 percent for the supermarkets.

The association also points to the closure of 450 service stations last year and warns that a further 3,000-4,000 outlets are at risk.

UFIP is lobbying the government for an end to tax breaks on natural gas to the detriment, notably, of fuel oils.

The association also claims that its members are operating under a 'financial handicap' in relation to their EU counterparts, because of high labour costs, trade taxes and the obligation to use French-registered ships.

No Iraqi oil sales

Last month the Iraqi government rejected a UN Security Council resolution permitting it to export $2 billion worth of crude over six months for the purchase of food and medicine.

Iraq wants a total lifting of the oil ban. The volume which could be sold under the latest UN resolution is only 600,000-700,000 b/d.

According to Dr Fadhil J Chalabi, Executive Director, Centre for Global Energy Studies, Iraq is likely to be able to produce 2 million b/d after sanctions are lifted, reaching the pre-war level of 3.3 million b/d two or three years later.

He said that Iraq had the potential to expand production to even higher levels – several new fields awaited development. But financing any expansion would prove an enormous problem. 'Iraq has been reduced to a poor country,' he said. The Iran-Iraq and the Gulf wars had destroyed considerable oil exporting and loading capacity and basic infrastructure, while the country's $60 billion debt continued to escalate. He estimated that $85 billion in oil revenues had been lost over five years.

Dr Chalabi described the government as 'crumbling' and said it existed 'only as far as to protect the regime itself – nothing more.'

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EEG Discussion Group

'The Hedging Efficiency of Crude Oil Markets'

By Paul Horsnell, Associate Director, Oxford Institute for Energy Studies
Alban Brindle, Marketing Manager, Trafalgar Commodities

Chairman: Walter Greaves

Wednesday 10 May 1995, 17.00 for 17.30 – 19.00 at the Institute of Petroleum

If you plan to attend, please advise Jenny Sandrock at the IP. Tel: 0171 467 7104 (direct line) Fax: 0171 255 1472

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Exploration and Production Discussion Group

'CRINE or Decline – The Successes of the Cost Reduction Initiative'

Speaker: Mr Vic Tuft, Director of the CRINE Secretariat.

Thursday 18 May 1995, starting at 17.00.

Enquiries: Mr Sjoerd Schuyleman, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR Tel: 0171 467 7132 Fax 0171 255 1472

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Combined EEG/BIEE invitation to the launch of

'BP Statistical Review of World Energy 1995'

Presented by Mr Peter Davies, Chief Economist, BP

Friday 23 June 1995, 14.45 for 15.00 at Britannic House, 1 Finsbury Circus, London EC2

Numbers are limited and applications will be accepted in order of receipt. Last date for receipt of applications is Friday 16 June 1995.

Application form from Jenny Sandrock at the IP. Tel: 0171 467 7104 (direct line). Fax: 0171 255 1472

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EEG Discussion Group

'Planning Future Refinery Hydrogen Requirements'

Speakers from Air Products plc and Kinetics Technology International BV

Wednesday 5 July 1995, 17.00 for 17.30 -19.00 at the Institute of Petroleum

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Outlook brightens for Tunisian energy

By David Buckman

Tunisia's energy fortunes suffered a jolt in 1993, when the traditional net exporter of oil became an importer. Additional production will reverse that situation and the outlook is brightening with much promising acreage on offer, keen company interest in acquiring blocks, new finds and imminent output from an important offshore gas field. A boost in the Trans-Med line's capacity and a joint search with Libya are two more positive aspects.

For several years the North African state's energy planners feared the transformation that has haunted major oil producers such as Indonesia and China: that slumping output and growing home demand would eliminate the export surplus. Tunisia's oil production of around 100,000 barrels per day (b/d) is small by Indonesian and Chinese standards but it has long provided valuable income. When in 1993, for the first time in over 20 years, Tunisia became a net importer with output dipping to just over 98,000 b/d, the exchequer saw a 1992 energy balance surplus of $142 million change to a deficit of $23 million.

Elf Aquitaine produces crude from Ashtart field

It was a depressing development for a government that since the mid-1980s had economically transformed the economy. Strict austerity had trimmed the budget deficit and inflation, and economic growth was regularly running at well over 6 percent a year. To crown these achievements one official in 1992 forecast 200,000 b/d of oil production in 1993, up 80,000 b/d on the then-current level – as it proved, a wildly over-optimistic hope.

State oil firm Enterprise Tunisienne d'Activités Petrolières (Etap) continues to push the virtues of Tunisian acreage for explorers. At present 16 fields have been developed to yield 100,000 b/d plus modest gas, with 28 private Tunisian and international companies actively involved in hydrocarbon operations. About 50 discoveries of some significance have been made onshore and offshore, and it is probably only the development of some solid infrastructure, especially offshore, that is necessary to see some of them tied in to production. Etap points to a history of 465 exploratory wells and 140,000 km of seismic data being available for scrutiny, claiming 'a high oil potential, a flexible hydrocarbon law and outstanding political stability' for the country.

Exploration interest

There has been a definite surge in exploration interest lately, with companies such as Louisiana Land & Exploration, Union Texas Petroleum, Pluspetrol, Premier Consolidated and a group led by Euromin taking stakes. A healthy 20 exploration wells was targeted for 1994, with a lot of action promised in the next few years.

One recent encouraging discovery has been made by Samedan Oil of Tunisia on its 1.2 million-acre

Cap Bon permit in the Gulf of Hammamet. Zelfa 1, 18 km offshore in 190 feet of water, achieved a combined flow rate of 4,540 b/d of oil/condensate and associated gas from three zones, ranging from 51-112 ft thick. The company hopes 'to proceed with delineation drilling later this year'. Samedan has become one of the most active companies in Tunisia in the last few years, working alongside equal partner Neste, with Etap having a right to participate in development.

The combine had a setback recently at the Isis oilfield, in the Gulf of Gabès. This has long been described as a new producing reservoir. It was found by Total in 1974 when the first well yielded 2,500 b/d and further drilling encouraged the obtaining of an exploitation permit in 1980. The reservoir was reckoned to hold 110 million barrels of oil, with 30,000-40,000 b/d of output feasible. As recently as mid-1993 Etap declared that it had been decided to tap Isis using a floating production system, with a 3D seismic programme and another well due. However, late last year, although the well tested at unstabilized rates up to 3,811 b/d and Samedan's parent Noble Affiliates said that it was 'encouraged' by the limited tests, it decided to write off the investment as 'the results are not considered to be sufficient to proceed with development at this time.'

Reserves for 45 years

Tunisia's reserves of 1.7 billion barrels are enough at present production rates to last for almost 45 years. A valuable contribution to reserves and output has been made in recent years by the reservoirs Belli, Sidi el Kilani and Cercina.

Marathon discovered Belli oilfield in June 1991, onshore in northern Tunisia with an encouraging 6,800 b/d from the Grombalia permit. Six months later it was put on long-term test, crude being trucked to the country's only refinery, Bizerte, then in 1992 output was boosted to around 15,000 b/d. Onshore discovery Sidi el Kilani was made about four years before Belli by Kufpec in the Kairouan Nord permit. The field soon went on stream at 3,000 b/d, a series of further wells went down and output of 15,000-20,000 b/d was expected. Late in 1993 Kufpec resolved to double output from the field to 10,000 b/d and then to 15,000 b/d in April 1994 with expansion of its installations.

A recent encouraging discovery onshore is Texaco's El Jem 1, reported in August 1992 in the El Jem permit 170 km south of Tunis. It was the first well drilled by Texaco's joint venture with Conquest Exploration Tunisia. The well flowed 3,600 b/d of 42° API crude and 3.7 MMcfd of gas and 'extensive evaluation' was promised. Last year Premier Consolidated took a 30 percent stake in the permit from Conquest and promised appraisal of the El Jem 1 find. The acreage is close to producing fields to the northwest and south and it contains a number of undrilled exploration prospects.

The most encouraging oil production development offshore has been the coming on stream of Cercina field, named after the submerged remains of a Roman city and lying in only two metres of water near the Kerkennah Islands. British Gas found the field on the Kerkennah West block in1992. Cercina went on stream, after four successful appraisal wells had been drilled, in the first half of 1994 at 4,000 b/d. Crude moves by pipeline to an offshore loading station and is transported onwards to refineries by tanker. By 1995 British Gas has resolved to produce 10,000 b/d.

Traditionally, Tunisian output relied on one major onshore field, El Borma, operated by Agip/Etap in the interior, close to the border with Algeria, and one offshore field, Ashtart, operated by Elf in the Gulf of Gabès. El Borma, found in 1964, has remained capable of producing 40,000 b/d, Ashtart, found in 1971, just over half that. In the early 1980s Ashtart was able to attain 45,000 b/d but by 1985 it had dipped around 20,000 b/d despite water injection. Elf has striven to keep up the production of what was long Tunisia's only offshore producing field, bringing in a new platform and gas injection, and it continues to form plans. In mid-1994 Elf reached agreement with the government for further development, with tenders for equipment and upgrading of platforms now under way. A new platform will be installed, 14 new wells will be drilled – 12 for production – and substantial new reserves in the northeast of the reservoir will be tapped. By spending over $200 million Elf hopes for an impact on production from the mid-

Miskar offshore field

Artist's impression of Tazerka field development

1990s, with field life extended beyond 2010.

The only other producing field offshore is Tazerka, which like Ashtart has tailed off recently. It went on stream in the Gulf of Hammamet late in 1982 and Shell Tunirex hoped that production would build up to 10,000 b/d. Although it marginally exceeded that figure in 1983 it has now dipped to under 2,000 b/d despite additional drilling. Tazerka was developed with a novel floating production and storage unit, the recoverable reserve of around 10 million barrels being insufficient to justify a line to shore.

'Gas is of rising importance in the Tunisian energy sector'

The current producer of Tazerka is Samedan, which like British Gas has become one of the most active operators in Tunisia in the l990s, both holding substantial acreage. Apart from the Cap Bon concession, where the Zelfa 1 discovery has just been made, the Samedan-led group has been conducting a review of its acreage, into which Neste farmed late in 1992, taking between 31-50 percent stakes in six concessions and one exploration licence.

Apart from the Cercina offshore oilfield, British Gas has built up a portfolio of modest crude producers. Also in the Kerkennah West permit, but onshore, it is developing Rhemoura, discovered early in 1991 with a good flow of 7,600 b/d. Kerkennah West also contains other landward production: El Hajib/Guebiba and Gremda/El Ain.

Bioremediation

An unusual feature is the bioremediation plant, in which investment has been between $500,000 and $1 million. Using novel technology, contaminated drilling muds are treated with bacteria, 'to degrade diesel oil associated with drill cuttings into biomass, water and carbon dioxide.' The success of the process has drawn interest from the local olive oil industry for use in the treatment of organic wastes. Oil-based cuttings from British Gas well sites are handled, and British Gas has been asked by other companies to process muds.

Gas prospects

Gas is of rising importance in the Tunisian energy sector and here British Gas is set to make a major contribution. It is developing the Miskar offshore gas field, in the Gulf of Gabès region Amilcar permit, which it has claimed 'will enable the country to become self-sufficient in gas,' releasing oil for export. At present nearly all commercial gas produced in Tunisia stems from the El Borma oilfield, which accounts for about a third of domestic needs. While indigenous gas production in the early l990s has fallen to around 370 billion cubic metres a year, demand is around 1.1 billion cubic metres a year, the national reserve being just over 90 billion cubic metres.

Local production is supplemented with gas taken as a transit fee from the Trans-Mediterranean pipeline from Algeria to Italy. The Italian national electricity agency, ENEL, has just signed an agreement for transit of another 4 billion cubic metres a year of Algerian gas through the 370 km of line on Tunisian territory. This will raise ENEL's availability from 6 to 10 billion cubic metres a year. The fee to Tunisia is 5.25 percent, available in gas or money.

Miskar was found by Elf in 1975 and several attempts were made to exploit it before British Gas submitted a development plan to the government in late-1990. It said that $600 million would be spent over three years to tap a recoverable reserve now put at over 23 billion cubic metres, which would 'provide a secure supply for 20 years.' British Gas tells *Petroleum Review* that 'first production and commercial gas sales are scheduled for June 1995.' British Gas has a contract with Société Tunisienne de l'Electricité et du Gaz to purchase up to 4.5 MM cu m/day of gas for five years, 5.7 MM cu m/day after that.

A 24-inch line, 120 km offshore and 3 km onshore, will move gas to Hannibal processing plant, 20 km south of Sfax port. In the field there is a 9.6-MM cu m/day production platform, an accommodation platform and a flare stack. Compression can be added later.

A further source of gas for Tunisia in the long term could be the November 7 joint development zone with Libya. Drilling is planned, and several tempting structures have been identified.

Refining the fuels of the future

By Charles J Krambuhl, Director, Manufacturing, Distribution and Marketing, American Petroleum Institute

On 1 January the American oil industry introduced the biggest change ever in the manufacture, storage and distribution of gasoline. It brought reformulated gasolines to market for 30 percent of its consumers in 17 states and the District of Columbia. The new fuel will help reduce the groundlevel ozone that leads to smog.

The new gasoline is an example of the potential of reformulation technology to create cleaner burning gasolines. This technology helps to position gasoline as the fuel of the future for the vast majority of American motorists.

This article discusses reformulated gasoline; the improved environment that cleaner burning motor fuels have helped to produce; the changes, challenges and costs the American refining industry has faced because of the dual demand to produce new fuels and reduce stationary source emissions; and the effort to substitute alternative fuels for gasoline.

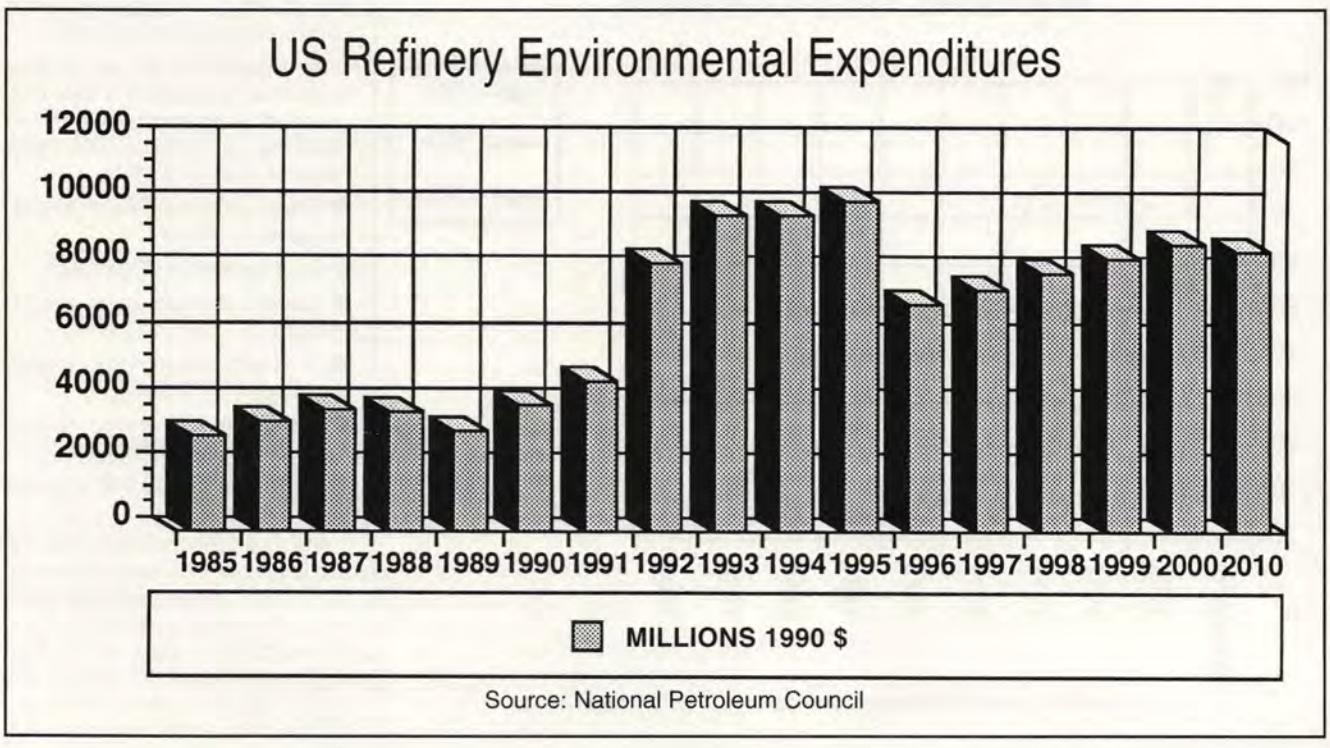
Reformulated gasoline

US law (the Clean Air Act Amendments of 1990) requires that reformulated gasoline be the only gasoline sold in nine urban areas – Baltimore, Chicago, Hartford, Connecticut, Houston, Los Angeles, Milwaukee, New York, Philadelphia and San Diego.[1] The law allows states to include other communities in the programme if the state believes it is necessary to meet its clean air requirements. As a result, reformulated gasoline is the only gasoline sold in many urban areas from New England to Virginia, parts of Texas, the Midwest and Southern California. That created a market for 2.3 million barrels a day of reformulated gasoline.

The introduction went smoothly, for the most part. Supply was sufficient. And even the last minute reversals – in which parts of Maine, Pennsylvania and New York decided they did not want reformulated gasoline after all – will be accommodated.

These reversals were motivated by concerns over cost. Reformulated gasoline is more expensive than the conventional fuel. The US Environmental Protection Agency (EPA) estimated that reformulated gasoline has manufacturing and distribution costs that are at least 3 cents to 5 cents more per gallon than conventional gasoline. That range does not include the costs of testing, compliance, storage and transportation.

In March 1996, California requires a more severely reformulated gasoline to meet fuel specifications statewide that are stricter than federal standards. California will require lower sulphur as well as lower Reid vapour pressure, olefins and aromatics to further reduce volatile organic compounds and toxins. Benzene levels will be reduced and distillation temperatures lowered.



Source: National Petroleum Council

The oil industry did not oppose these opt-outs. But it was concerned about the resulting requirements for large amounts of conventional gasoline in areas that were to consume over 8 percent of the total nationwide demand for reformulated gasoline.

Variety of complaints

Additionally, the industry has been equally concerned about complaints heard from some Milwaukee motorists who said that reformulated gasoline made them feel ill, reduced their mileage and made their cars stall or run rough. There were even a few reports of damaged engines. Others said the new fuel damaged the small engines on chain saws and snowmobiles. And there were complaints about the cost. Wisconsin's governor even asked EPA to suspend the use of reformulated gasoline in his state. EPA refused that request but agreed to conduct additional studies based on the complaints it received, even though fuels similar to reformulated gasoline have been widely studied and even used elsewhere for years without consumer complaints.

In an effort to respond directly to complaints in Milwaukee, the industry sent its experts there to work with the public, the media and the government. It established a toll-free telephone line to respond to consumer complaints and to help the public get the facts about reformulated gasoline. The industry said it would label pumps that dispense reformulated gasoline so that motorists would know whether oxygenates in the fuel were made from an alcohol or an ether.

Impressive results

Despite complaints, the fact is that reformulated gasoline produces impressive results in the 70 million vehicles that use it. This is a cost-effective fuel in areas where it is needed to improve air quality and to help the elderly and those who have asthma, emphysema and other respiratory ailments to breathe more easily. As EPA Administrator Carol Browner has noted, 'Reformulated gasoline is one of the most cost-effective programmes ever created to reduce harmful air pollution.'

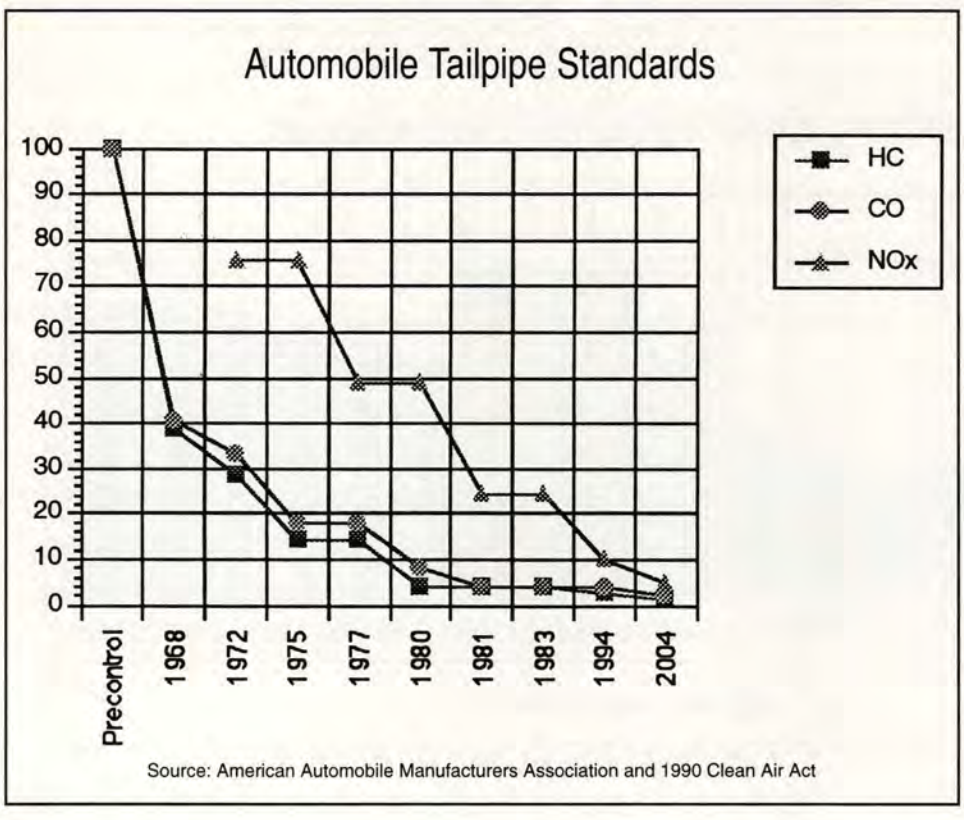
Reformulated gasoline is designed to reduce emissions of smog-forming volatile organic compounds (VOCs) and air pollutants from automobiles. VOCs will be reduced by 15 percent in 1995. By the year 2000, VOCs will be reduced by as much as 29 percent. And nitrogen oxides will decline by 5 percent to 7 percent. All comparisons are with 1990 levels of conventional gasoline.

The reformulated gasoline that is now available is free of lead and heavy metals. It contains no more than 1 percent benzene by weight and includes detergents help to keep engines clean. The fuel has at least 2 percent oxygen by weight. Areas also participating in a state's winter oxygenated fuels programme to reduce carbon monoxide emissions must use reformulated gasoline with at least 2.7 percent oxygen.

Cleaner fuels and cleaner air

The introduction of reformulated gasoline marks the fifth time in 20 years that the oil industry has introduced cleaner burning fuels. Prior to the introduction of reformulated gasoline:

- Eighty-five percent of the sulphur in diesel fuel for highway vehicles had been removed to reduce particulates (soot and smoke).
- Lead was removed from gasoline.
- Gasoline's Reid vapour pressure was cut to reduce volatility in the May-to-September summer driving season.
- And oxygen was added to gasoline sold in certain parts of the country in winter to reduce carbon monoxide emissions.



Source: American Automobile Manufacturers Association and 1990 Clean Air Act

As a result, the air we breathe is cleaner. In October 1994, EPA reported 'continued progress' in reducing six major air pollutants between1984 and 1993:

- Smog, or ground-level ozone, dropped 12 percent.
- Lead decreased 89 percent.
- Sulphur dioxide levels fell 26 percent.
- Carbon monoxide levels declined by 37 percent.
- Particulates decreased 20 percent (from 1988-1993).
- And nitrogen dioxide was cut by 12 percent.

Much of this progress can be attributed to cleaner-burning fuels and cleaner running vehicles. In fact, the American Automobile Association has reported that cars and light trucks represent less than one-third of the overall emissions that

contribute to ozone problems in metropolitan areas.

Vehicle emissions are a declining percentage of all emissions. For example, in 1984 hydrocarbon emissions from highway vehicles were 37 percent of total hydrocarbon emissions. In 1993, they were only 26 percent. And over the past decade, large cuts in auto emissions have helped to make up for increases in emissions from other sources. This suggests that cleaner burning fuels in cleaner running vehicles can help to meet our nation's clean air goals. Reformulation technology and changes in the vehicles will help to continue the progress that has been made.

When cleaner burning fuels are used in cars that meet federal exhaust standards phased in between 1994 and 1996, tailpipe emissions of hydrocarbons, carbon monoxide and nitrogen oxide are cut by an average of 95 percent from their pre-control levels of the 1960s. And if necessary, exhaust standards twice as tough as those for the mid-1990s could be required in 2004. That would reduce pollutants by more than 97 percent, on average, from their 1960s levels.

Refining cleaner burning fuels

The introduction of new, cleaner burning fuels has created a costly challenge for the US refining industry. A review of that industry puts the changes it has experienced, the challenges it faces and the costs it must bear in perspective.

Recent refining history

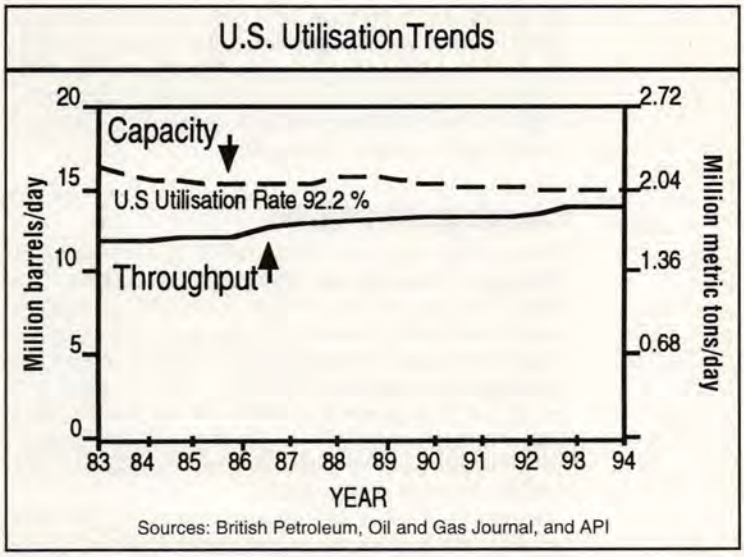
The United States has one quarter of the world's operating refineries and one fifth of the capacity. During the 1970s, the number of active US refineries rose while operating capacity increased by half, to 18 million barrels a day, or about 2.5 million metric tonnes a day. In late 1981, there were 315 facilities in the United States. Much of the increase was in plants sustained in part by government subsidies through crude oil allocation, entitlement programmes and price controls. These ended in 1981, at the same time that the quality of crude in world trade decreased. That reduced the need for simple refineries and increased the need for complex facilities.

Over the past dozen years or so, more than 40 percent of US plants closed, while the operating capacity and complexity of the remaining facilities increased. Those that closed were called 'tea kettles.' That name reflected their status as old, small, simple plants. In most markets, the shake-out left the United States with a much improved modern system. We now have 171 operating refineries.

There has also been a change in employment. Since 1982, one refinery job in three – almost 54,500 jobs – have been lost to closures and efficiencies. Overall, the US petroleum industry has lost 420,800 jobs between 1982 and 1994. As a result of all that consolidation, there were large gains in productivity during the 1980s.

Today, current capacity is sufficient to meet demand.

Throughput figures climbed during the 1980s and into the 1990s. But US capacity remained constant – at 15 million barrels, or 2 million metric tonnes a day. As a result, utilisation rates increased from just 66 percent in 1982, to over 92 percent by 1994.



This increase is attributed to capacity absorption as refiners try to recover capital invested to meet environmental standards.

There are good reasons to doubt that excess capacity will be reduced much further in the near future. Refineries have been slow to close in recent years. In part, investors took a 'wait and see' attitude, hoping that the environmental rules would change in their favour. Some refinery operators believed they could run refineries being sold by the major oil companies more efficiently than the majors, and bought some of those plants. And a few operators found that it cost less to stay in business than to meet the environmental costs of closing.

Shutdown costs can run anywhere from £32 to £64 million [$50 million to $100 million] a plant. One observer notes that this lowers the barriers of entry, with some refineries being sold at fire sale prices. And there's one other reason industry capacity has stabilised. The United States has a multi-tiered product market. Some areas need reformulated gasoline, and many others do not, so some refineries can continue – in a niche market – that would not exist if reformulated gasoline were required everywhere.

Higher costs

Refiners face high capital, operating and maintenance costs to produce the new fuels and meet other environmental requirements. With new environmental standards in effect, refinery environmental costs are expected to reach almost £6.4 billion [$10 billion] in 1995. These cash outlays include capital expenditures for pollution abatement, for operating and maintenance expenses and the costs of producing the new fuels. By comparison, just five years ago, the refining industry was spending about £2.5 billion [$3.9 billion] to comply with environmental requirements, including both capital costs and operating expenses.

During this decade, refineries must make capital expenditures of £23.8 billion [$37 billion] to meet environmental standards. That's £3.9 billion [$6 billion] more than the book value of the refineries themselves.

The US National Petroleum Council (NPC) estimates that the industry must spend £98 billion

[$152 billion] between 1991 and 2010, to comply with existing and anticipated environmental regulations. These costs are in addition to the estimated £9 billion [$14 billion] of capital expenditures for facilities to make reformulated and oxygenated gasoline and ultra-low sulphur diesel fuels.

Looking to the future

How will these costs affect refiners? The National Petroleum Council put them in perspective: 'The projected cost increase in [the year] 2000 for regulatory compliance is more than twice the US refining, marketing, and transportation industry's historical average net income in the 1980s....' The report went on to say that given projections of flat US demand and increasing supply from oxygenate blending into gasoline, recovery of these costs will be difficult until further capacity is shut down.

In the face of these changes and the costs they impose, refiners are preparing for the future. Some companies are cutting capacity to save on capital expenditures. Other companies are focusing on regions where they already have an advantage. Still others are looking for crude oil producing partners abroad. For example, Pemex bought half of a Shell refinery in Texas. Foreign companies that own US plants now produce about 1.5 million barrels a day. That is nearly 10 percent of total US refining capacity. We expect more alliances between international and national companies will be formed.

As a result of all of these changes, smaller, low conversion refineries that do not have the resources needed to make the new fuels will probably find market niches, or disappear. Additionally, the survival of a number of ageing larger refineries may be suspect. But if excess capacity is retired, refining margins should improve. So despite continued consolidation, and costly expenditures ahead, there may be some optimism in the US industry for the long term.

Alternative fuels

Despite the potential for reformulation technologies to provide the clean burning fuels of the future and the success the industry has had in helping to improve air quality, there is a concerted effort by our federal and state governments to promote alternative fuels through various rebates, tax breaks, low-interest loans and other subsidies. The subsidies disguise the higher cost of these alternatives in an attempt to make them competitive with gasoline.

The Energy Policy Act of 1992 (EPAct) mandates federal and state governments, and possibly private interests, to purchase alternative-fuel vehicles for fleet use. EPAct sets a national goal of replacing 10 percent of projected motor fuel use in the year 2000 with alternatives. That goes up to 30 percent in 2010. In other cases, the federal government has simply mandated the use of alternatives.

California, New York and Massachusetts are requiring electric vehicles. In California in 1998, 2 percent of vehicle sales – or 40,000 vehicles – must be so-called zero-emission vehicles or ZEVs; in 2001, 5 percent; and in 2003, 10 percent. Because electric vehicles (EVs) do not emit pollutants when driven, EVs are seen as the only vehicles capable of meeting California's ZEV mandate.

An EV costs $10,000 to $30,000 more than a conventional vehicle. And an overnight recharging of its batteries will take it less than 100 miles. Using headlights, a heater or air conditioner, windshield wipers or a radio would reduce that mileage. So would climbing a hill or driving in extremely cold weather.

Even more important, EVs are not zero-emission vehicles. They are more aptly described as 'elsewhere emission vehicles' or 'remote emission vehicles' because the power plants that generate electricity to recharge EV batteries generally emit pollutants.

The oil industry opposes California's electric car mandate, as it opposes other alternative fuel mandates and subsidies, because they do not offer a cost-effective solution to air quality problems. The industry believes, instead, in a level playing-field on which fuels compete on their merits and markets determine the development and use of alternatives.

Governments have a poor record of picking technological winners. And giving one fuel or vehicle a subsidy or mandate could retard the development of new technologies not favoured with the same special treatment.

The nation can continue to achieve improvements in its air quality without subsidies or mandates. If the national government will set the environmental goals, the petroleum industry will help to meet them.

But trying to meet those goals, in the face of continuing subsidies and mandates, puts the oil industry in a difficult position. On the one hand, our industry must spend billions of dollars on new fuels while, on the other hand, the federal and state governments move as many vehicles as they can away from petroleum-based fuels. The question for the industry is whether it will receive a return on the huge capital investments it must make.

Conclusion

The refining industry has been facing a number of changes including consolidation, technological challenges and extraordinary costs. The industry is expected to respond to these, to satisfy the governments that regulate it and serve the customers who support it – while also facing and fighting political pressure for alternative fuels. It is a tumultuous time.

And yet the industry continues to develop strong, competitive products that are cleaner burning. Reformulation technology – the basis for the fuels of the future — is the latest of these developments. It provides high performance and convenience and it will promote improvements in air quality, all at a reasonable cost.

The petroleum industry supplies 97 percent of this country's transportation fuels. These fuels, and lubricants, are three quarters of the total business of the nation's 171 refineries, 193,000 retail fuel outlets, thousands of tanks and terminals, pipelines that could encircle the Earth eight times, and thousands of trucks, barges and ships that connect them. This high-tech industry will continue to be the primary supplier of clean burning transportation fuels in the United States.

This article is based on Mr Krambuhl's presentation to WEFA Energy's 1994 European Oil Refining Conference.

In the past, the world oil markets had two major risks to manage: supply and price. But now there is a third. With pollution laws in the United States and elsewhere becoming increasingly stringent, global environmentalism is set to become a key variable in the trading of oil products. And with it comes major new trading opportunities.

The impact of US environmental laws

By Peter Fusaro, President, Global Change Associates

The cost of producing petroleum products in the United States is becoming more onerous than abroad. Regulations such as the Clean Air Act amendments of 1990 and the Oil Pollution Act of 1990, which created additional uncertainties in oil markets at the end of last year, are having major impacts on refiners and marketers. Higher storage and transportation costs; added capital expenditures; product exchange complexity; product segregation and scheduling problems; product degradation problems; and multigrade fuels are all helping to drive capital investment decisions to either invest, sell or shut down.

'These environmental changes represent a major opportunity for foreign refiners'

These changes are having a direct impact upon import and export opportunities in the world oil markets. For when the majors exit some of their downstream operations in the United States, as both Exxon and Chevron have done, the net effect is an export of US refining capacity and an increased dependency on foreign imports of petroleum products and blendstocks. These changes also represent a major opportunity for foreign refiners from other regions of the world to export higher value-added products and blendstocks to the supply-dependent United States, particularly to the east and west coast markets.

The net effect is that the incremental barrel to the US market becomes an imported barrel of product which will be increasingly competed for in international oil markets. Changes in fuel specifications to more stringent quality standards in other regions of the world will only exacerbate this situation. Global environmentalism will now be the key variable in oil products trade for years to come.

Motor fuel trends

The most stringent air quality regulations will be focused on California and the northeast, which account for 33 percent of the US automobile market. Yet, while cleaner fuels are environmentally mandated for sale in the United States, there is no mandate for all refiners to produce these fuels. Therefore, in the future there will be increased exports of 'conventional' fuels to other markets, including Europe, South America and the Pacific.

At the same time, imports are likely to increase. According to the World Oil Refining Logistics and Demand (WORLD) LP model results, developed by consultants EnSys Energy & Systems, the high price differential between reformulated gasoline and environmentally 'unregulated' conventional gasoline could rise to 20 cents/gallon or $8/bbl in the US market. This represents a powerful incentive for foreign refiners to produce some portion of reformulated gasoline or gasoline components in their total output. This is particularly so since non-US refiners can produce reformulated gasoline more cheaply than US refiners who are constrained by commitments to high levels of reformulated gasoline (RFG) production and barred by the Clean Air Act from dumping conventional grades in the United States.

Moreover, as US crude oil production continues to decline, US refiners will be forced to turn increasingly to the world markets, losing their traditional competitive advantage.

The prospects of natural gas, other alternative fuels and energy conservation may be challenging oil's dominance but by the year 2000 the US market will still account for 25 percent of the world's gasoline demand. And although an annualised growth rate of 0.7 percent for US gasoline demand does not seem large, its impact is now overly magnified because of regulatory requirements, as we have seen in the futures markets recently. Moreover, this demand for increased volume must be supplied from existing refineries, which continue to run at maximum throughputs of over 90 percent.

What all this means is that increasingly stringent US product specifications are introducing both new risks and trading opportunities to world oil markets and that in this new pricing environment, foreign refiners are likely to have significant costs advantages.

Preliminary results of a study carried out by Global Change Associates, entitled *Global Environmental Change, Trade Patterns and Oil Price Volatility*, show that US product imports may climb to 4 million barrels per day and product exports to 1.7 million barrels per day by 2000. The imports will include reformulated gasoline and blendstocks, jet fuel, low sulphur diesel and low sulphur resid. The exports will be lower grade or 'conventional gasolines', high sulphur middle-distillates and high sulphur fuel oil. There will also be an increased dependency on Persian Gulf crude oils (as indeed there will be in Europe and Asia).

What we're projecting, therefore, is that 'environmental quality' will now emerge as the *major* new parameter in global transportation fuel markets. These shifts will alter refinery processing and blending economics in all world regions, particularly the high-growth markets of the Asia-Pacific.

In the past, we had supply and price risk to manage. Now we have a new identified risk to deal with – 'fuel quality risk' or 'environmental risk'. Its impact on the US oil products markets will be: greater fragmentation of the product market with more grades and tighter product specifications;

higher dependency on product imports; increased dependency on the Middle East; a contracted US refinery base; increased product price volatility and increased use of derivative product risk management structures.

Product trading will also undergo a significant change. In the past, ad hoc opportunistic product shipments were the usual trade pattern. Now, longer-term processing and marketing relationships will be formed. In this way, foreign refiners will have to follow the example of the Venezuelans and the Saudis and make downstream commitments to the US and other oil markets.

Venezuela and Saudi Arabia have announced multi-billion dollar investments in refining geared towards clean and reformulated fuels plus methanol and oxygenates production. These countries are targeting the United States as one market for these clean fuel investments. Other foreign refiners have displayed a willingness to enter these markets to a more limited degree, perhaps providing only gasoline blendstocks.

The movement to clean and reformulated fuels adds new processing requirements for desulphurisation, hydrogen generation, and production of high-quality gasoline blend components such as alkylates and ethers. These, in turn, require gas and natural gas liquids (NGLs). Those regions that have ample supplies of low cost gas (for fuel and hydrogen production) and NGLs thus have a competitive advantage in the production of these fuels.

'The new wave of refinery consolidations may actually produce a more efficient, complex and profitable US refining industry'

Diesel fuel changeover

The low sulphur diesel fuel mandate implemented in the latter part of 1993 in the United States had a profound effect on the transportation market at that time. Price spikes, supply dislocations, and the export of high-sulphur diesel resulted from the mandate. Some of that product was exported to other markets.

The change to reformulated gasolines will be more complicated and is only just beginning. Some estimate that as many as 50 to 70 new grades will be created. The Colonial Pipeline, the major product carrier for the US east coast, has designated 260 different grades of gasoline for this year. Product fungibility now becomes a key variable in US and world products markets and therefore a new risk to manage.

Synergies with other markets

A synergy exists between the US movement to reformulated fuels and the movement to lead phase-down in other regions of the world. Lead phase-down creates demand for higher clear pool octane. US and foreign refiners can reallocate blend components, such as reformate, fluidised catalytic cracker (FCC) gasoline and butane into unregulated conventional gasoline in this new global gasoline market-place.

It seems likely that alternative fuels, such as compressed natural gas (CNG) and propane will be given a boost by the inability of US refiners to manufacture enough gasoline to meet Clean Air requirements. Nevertheless, while alternative fuels have been given certain incentives, their present market share is limited. The US Environment Department has projected that 2 million b/d of crude oil will be displaced by 2010 by the alternative fuel and vehicle programmes. But this seems highly optimistic as little infrastructure exists for CNG. Electric vehicles are mandated in the Californian market beginning in 1998 and other areas of the United States have indicated their willingness to follow the Californian regulations. However, it seems likely that an environmental premium will be paid to use these vehicles over gasoline or diesel fuel. Other longer-term developments are directed towards the fuel cell and hydrogen fuels, but commercial application of these technologies seems at least 25 years away.

The most optimistic projection by the American Gas Association estimates 10 million CNG vehicles by 2010. The reality is that today over 195 million cars and trucks run on gasoline and diesel fuel, and only 50,000 on natural gas. In 2010, more than 200 million vehicles will still run on gasoline and diesel fuels albeit in a cleaner form unless there is an unknown technological breakthrough in alternative fuels development.

Changing supply/trading patterns

In the past, US gasoline imports have been small - less than five percent of total demand. But environmental imperatives will cause this figure to rise during the 1990s. The leading gasoline suppliers to the US market are Venezuela, Brazil, Canada, Saudi Arabia and the United Kingdom. Potential clean product suppliers include Indonesia, Singapore, Korea and China.

So far, the import demand has been met by contract suppliers from Venezuela and Brazil and from short-lived trading opportunities with cargoes arriving from various regions of the world, including Europe and Asia. However, the changes in US gasoline trading patterns imply changes in the nature of international markets, away from spot cargo shipments toward more stable and sustained supply relationships.

The implementation of the Clean Air Amendments and low sulphur diesel fuel specifications are also impacting trading and supply logistics. Increased quality restrictions are providing uncertainties in both the gasoline and diesel fuel cash markets in terms of supply, price and demand. Changes in gasoline grades and specifications have continued to affect gasoline futures markets and are adding to the illiquidity of the NYMEX benchmark New York harbour gasoline contract. The Gulf Coast gasoline futures contract is not a viable alternative as it would introduce 'liquidity risk' into gasoline futures markets. Thus, the energy derivatives market with customised swaps and Over The Counter (OTC) options contracts is leading the way for gasoline price protection programmes in the United States. Some oil companies and financial institutions, such as BP, Morgan Stanley and Louis Dreyfus Energy, have sensed an opportunity in these markets and are now offering fixed price gasoline contracts to manage that inevitable 'environmental' price risk. In effect, they are imbedding the risk management tools within the

supply contract. These changes are directly influencing futures contracts for both crude and product on both NYMEX and the IPE.

The key issue is loss of product fungibility, which previously allowed the industry the flexibility to buy, sell and trade barrels of gasoline. Increased segregation of batches will make it less flexible for refiners, ultimately raising prices and adding more complexity to a system that previously worked very efficiently. This, in turn, will add to product imports.

The proliferation of product grades and regulatory waivers will cause supply disruptions at a local level, adding to price volatility. Gasoline blending will also be more complex as the blender must control not only Reid vapour recovery (RVP) and octane, but oxygen, benzene, and total aromatics content. Thus, more investment in tankage and sophisticated control equipment seems likely. While the new Republican Congress may relax some of these requirements, any further changes are, if anything, likely to confuse the motor fuel puzzle still more.

It also appears that changes in seasonality in clean products markets, which took place during the winter of 1992/93, may become the norm. What was formerly unusual product movement due to the price signal may become standard as trade patterns shift into sustainable supply relationships. This will require an improvement in inventory management from US refiners and marketers.

To sum up, fuel specification changes should add price volatility. Increased product imports and blending components will only add to that uncertainty. There will be different regional impacts of the Clean Air Act on the marketing and distribution of the petroleum products.

Refinery closures, asset ownership changes, and strategic alliances

The new wave of refinery consolidations, necessary to meet changing product specifications and onerous environmental requirements, may actually produce a more efficient, complex and profitable US refining industry.

One consequence of these changes has been the increased formation of strategic alliances between national oil companies and international, integrated oil companies, both upstream and down. In the United States, we have witnessed both Saudi Arabia and Petroleos de Venezuela acquiring refineries as channels for their crude oil production. The Saudis now own three refineries in the United States and the Venezuelans five. Saudi Arabia has a US refining capacity of 600,000 b/d, while Venezuelan capacity recently reached 925,000 b/d with the Lyondell joint venture. Similar strategic alliances seem in the offing in Asia Pacific. One example of this trend is the recent Saudi investment in Petron in the Philippines.

Offshore product storage facilities and marine terminal facilities, situated close to the US market but outside the country's environmental authority, should be quite lucrative in the future. The Caribbean, for example, is particularly well placed and Venezuela and Saudi Arabia have already bought up much of the Caribbean availability.

Another interesting trend in the wake of refinery sales and closures has been the move amongst oil trading companies to acquire refining and storage assets. Oil trading companies such as Vitol, Tosco, and Phibro have been active in buying and selling assets and other companies such as J. Aron and Louis Dreyfus Energy are known to be looking for more physical assets. This additional flexibility presents opportunities to move products quickly when market opportunities arise.

'Venezuela and Saudi Arabia have already bought up much of the Caribbean storage availability'

Some analysts feel that the import of gasoline and gasoline blendstocks will be limited during the switchover to reformulated fuels. They argue that European refiners and refiners in developing countries are in a fuel reformulation phase of their own. Thus, high octane unleaded stocks will be increasingly needed to handle compliance problems abroad. This is all true, but the big picture is that there is a global need for complex refineries with maximum flexibility to produce clean fuels because of the pace US refiners are setting.

Bunker fuel market

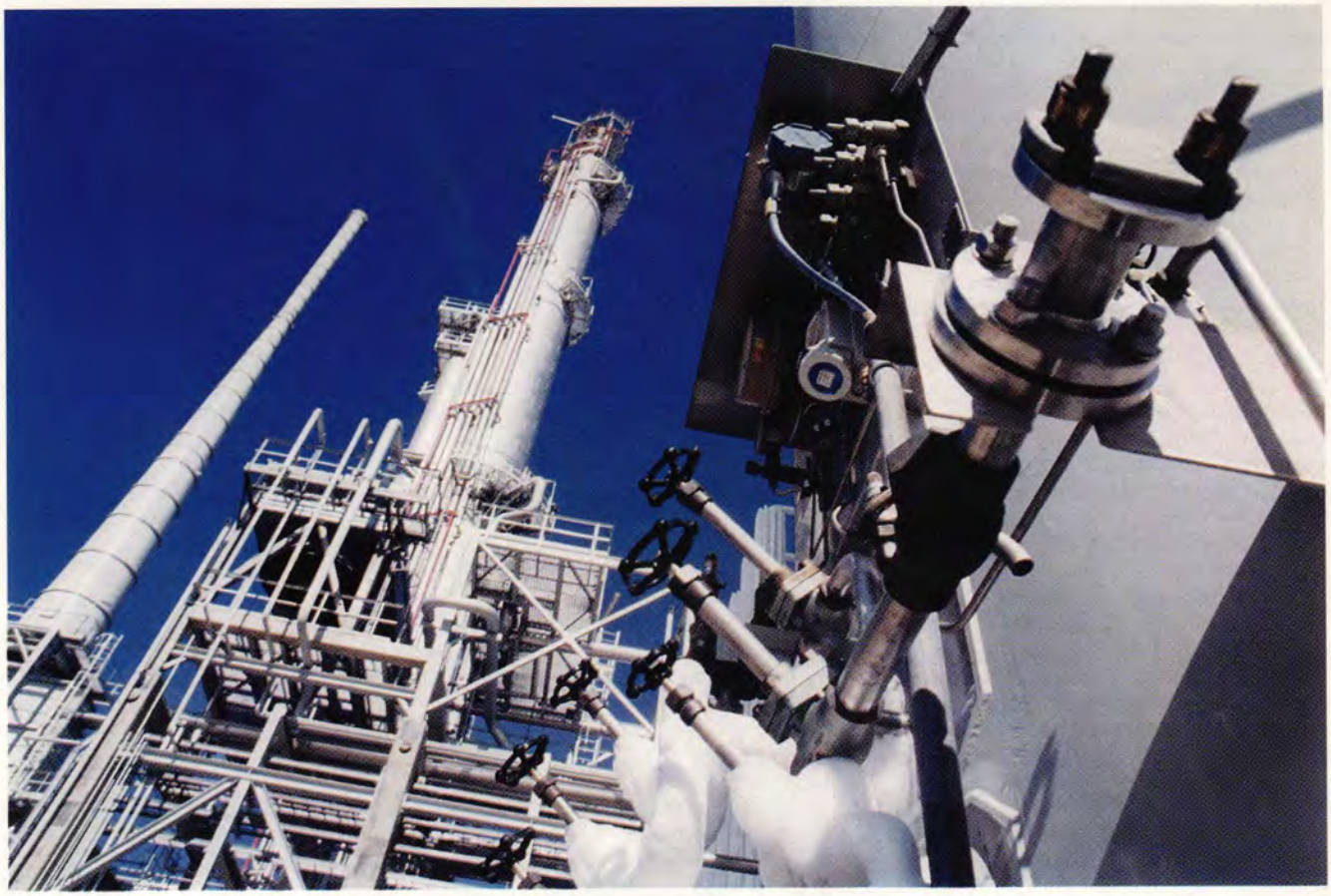
One major factor in all this concerns the bunker fuel market. Changes underway include the probable movement to international standards for sulphur reduction in bunkers, together with other fuel quality specifications. More importantly, when products trade begins to increase, we will witness the first significant upturn in world tanker markets for two decades, together with a rise in bunker fuel demand. It is another environmentally-driven trend worth noting.

The other variable in all this is the rapid and rising development of environmental concerns in Europe and Asia. Lead phase-down, stricter sulphur standards and oxygenates are changing the supply picture. Thus, there will be increased competition for 'greener' feedstocks and finished products through further fuel reformulations across the barrel.

Conclusion

Changes in the US products markets driven by EPA clean fuel mandates will affect world oil markets. The continued high demand growth of Asia Pacific oil markets coupled with the increased fragmentation and inflexibility of US oil markets are both an opportunity and a risk for oil traders. European refiners may be faced with both the need for significant investment in refinery upgrades and with a multi-layered products market. More product trading is a certainty, as is more price volatility. But this presents long-term opportunities in the United States, Europe and Asia to move product for higher value-added benefits all in the name of the environment. It also means more complex risk management structures that only the energy derivatives market can offer.

This is an edited version of the paper given at the 8th Oil Price Seminar held by the IP.



Refinery expansion brings more unleaded gasoline to Europe

Petróleos de Portugal s.a. (Petrogal) is wringing more high-value gasoline and jet fuel from each barrel of crude feedstock with a $650 million expansion of its refinery at Sines in Portugal. The company has changed its end-product mix without significantly increasing crude feedstock throughput. Production of gasoline and jet fuel has increased by 25.5 million barrels per year, an increase of 45 percent.

From the new expansion, 11 million barrels, or 43 percent of the total, will be devoted to unleaded gasoline production to meet growing demand in Portugal and the rest of Europe.

'The key to gaining higher processing efficiencies for unleaded gasoline production is the new $85 million gasoline complex within the expansion area,' said Carlos Pombo Rodrigues, Director General of the Sines Refinery Expansion Project. 'This complex means we can now compete globally. We may even be selling gasoline in the United States soon,' he added.

New gasoline complex at Sines refinery, Portugal

Portuguese government officials agree that the Petrogal project is the first step in placing the country in the world market-place.

'Before this expansion programme, Petrogal produced a lower percentage of high-value marketable products per tonne of crude,' Mr Rodrigues said. 'We used to convert 24 percent of our 200,000 barrel per stream day (bpsd) crude feedstocks into gasoline and jet fuel. We now process 35 percent of the same crude feedstocks into these valuable products, a 45 percent increase.

'At the same time, the heavier, less valuable products such as residual fuel and asphalt – once accounting for 52 percent – now account for 34 percent of our refinery product mix,' he explained.

Major units erected for the refinery expansion included a 35,000 bpsd fluidized catalytic cracker, a 26,000 bpsd viscosity breaker, a 45,000 bpsd vacuum distillation unit, two extractive mercaptan columns, an amylene treater, a sulphur recovery system and an 8,000 bpsd alkylation processing complex.

The refinery expansion began February 1992 and was completed in June 1994, one month ahead of schedule.

'Our plan was to build a world-scale refinery for

domestic and export supplies of unleaded gasoline,' Mr Rodrigues said. 'One key element in that plan was to select the most cost-effective advanced technology to produce 8,000 bpsd of blending agents for environmental fuel. These processing units would become Petrogal's new gasoline complex.

'We selected Phillips Petroleum Company's licensed technology for its HF (hydrofluoric acid) alkylation and hydrisom units. We use the blending agent (alkylate) produced with these units to boost gasoline octane without the need for adding lead,' he said.

In addition, the refinery added utilities, a cooling tower, an additional flare system, effluent treatment facilities, piping, and power and instrument cabling. Together, Petrogal, ABB Lummus Crest BV and Badger Company, a division of Raytheon Company, expended more than 660,000 man-hours to complete the refinery expansion.

The HF alkylation unit produced its first barrel of alkylate on 1 July 1994 and now is producing more than 10,000 bpsd of alkylate – 25 percent over unit design projections.

Safe alkylation a key to profits

Alkylation uses hydrofluoric or sulphuric acid as a catalyst to combine light hydrocarbons too volatile to be used in gasoline. The larger molecules formed in this reaction are used as a high-octane blending agent to boost octane in unleaded gasolines.

Using alkylate to increase unleaded motor fuel octane also reduces olefins, aromatics and other substances which are restricted in today's environmental fuels.

Petrogal chose the Phillips Petroleum HF alkylation process because of its safety and operating unit cost advantages. One major factor in the decision was the greater consumption of acid catalyst in the alternative sulphuric acid process, which would have required Petrogal to regenerate 100 tonnes of sulphuric acid per day.

'Since we had no on-site sulphuric acid regeneration capabilities, we would have had to ship sulphuric acid from Ghent to our port facilities here, then transport five 20-tonne trucks to the refinery each day,' Mr Rodrigues said. 'This would require our company to build new harbour facilities, new roads and purchase a fleet of trucks just for sulphuric acid transport.

'Beyond this enormous commercial penalty, we would also be faced with the possibility of safety risks to the community by moving that much acid daily,' he added.

The HF alkylation unit design uses gravity to move HF through the system, eliminating maintenance-intensive pumps and the high operating pressures required by other alkylation technologies.

This design also eliminates reactor stirrers and eliminates or reduces the need for circulating pumps, shaft seals and gasketed connections in the reactor circuit. The only pump moving concentrated HF is the one feeding the acid regenerator circuit.

Early in the project, a team of engineers from Petrogal, Phillips, Badger and ABB Lummus Crest BV, performed a series of thorough hazard and operations reviews. Engineering changes suggested by those reviews were incorporated into the alkylation unit detail design. Safety considerations were seriously addressed.

An extensive gasoline complex

The new gasoline complex also includes the Phillips Petroleum designed hydrisom unit for selective diolefin hydrogenation, a defluorinator to remove fluorides from butane and propane, an HF stripper, a depropanizer, the vertical HF reactor/settler, fluidised catalytic cracking unit (FCCU) and feedstock heater using refinery fuel gas and acid soluble oil (ASO) for fuel.

According to Meireles de Barros, the gasoline complex start-up project manager, 'It took us less than 20 hours to load the 70-cubic metre HF acid storage tank with hydrofluoric acid for the first time. We transferred the acid catalyst from tanker trucks into the unit simply by pressurising the unit with nitrogen, then pumping nitrogen into the tanker trucks, pushing the hydrofluoric acid into the storage tank safely and with minimal atmospheric vapours.'

He continued, 'The alkylate quality from the unit has been excellent – at start-up, the new HF alkylation unit produced alkylate with a Research Octane Number-Clear (RONC) of 97.8 and a Motor Octane Number (MON) of 95. Without the gasoline complex, we had been able to maintain a MON of only 88 with blending agents from the refinery's reformer.'

Manuel Leão Tavares, HF unit project engineer, said, 'Effluent containment was specially constructed for the complex. Concrete barriers surround the HF alkylation unit to contain any released HF scrubbed from the atmosphere by water deluge equipment. Effluent would be directed to special drain sumps and then to concrete containment ponds to prevent leaching into the ground or entering surface water.'

Fire precautions at gasoline complex at Sines refinery, Portugal

These holding ponds were specially designed. Three concrete basins were built to treat any run-off water from the HF alkylation unit, whether from operating the deluge system or just normal rain water. These wastewater basins, with the largest capable of handling 2,000 cubic meres of water, were set up to contain, control and neutralize any materials. Any effluent entering the first basin is agitated with caustic soda. In the second basin, calcium fluoride is removed from the neutralised spent caustic. The third basin is used for effluent storage.

Performance fine-tuned

The HF alkylation units produce higher octane alkylate through improved reactor mechanics and enhanced feedstock characteristics.

'Petrogal optimised its butene isomer distribution by using the Phillips Hydrisom process, thus improving its isobutane/olefin ratio and dispersion of reactants at the point of reaction,' said Larry Shoemaker, Phillips Petroleum Refining Technology Licensing Manager.

'Petrogal has 'tuned' its alkylation process to achieve a high isobutane-to-olefin ratio (13-to-1) for the best quality and highest octane alkylate,' he said.

The Petrogal gasoline complex enhances its feedstocks by using this process to upgrade C_4 hydrocarbons through selective hydrogenation and isomerisation. The unit selectively hydrogenates butadiene from the FCCU and isomerises butene-1 into butene-2. Using hydro-isomerisation to saturate elevated levels of butadiene in the olefin feedstock before feed reaches the reactor can reduce acid soluble oil (ASO) production in the unit and increase alkylate yield.

'These Hydrisom-treated C_4 feedstocks produce higher HF alkylate octane numbers, resulting in additional return on investment for Petrogal,' said Mr Rodrigues.

This process converts light olefins and isobutane into high-octane alkylate. Because it is clean-burning and can help reduce automotive exhaust emissions, alkylate is a highly valued component in premium and reformulated gasolines. Also, in the Phillips licensed process, octane increases are reached at lower reactor temperatures. Thus, the Sines refinery gains both a safety and cost advantage by keeping reactor temperatures as low as possible.

According to Mr de Barros, 'Decreasing reactor temperature favours formation of 2,3,4-trimethylpentane (RONC=102.7) versus 2,2,4-trimethylpentane (isooctane, RONC=100.0). Also, with our high isobutane-to-olefin ratio, we substantially reduce the production of heavy polymers (acid soluble oils) which would reduce acid purity.'

Product quality

To maintain alkylate quality and ensure optimal production, planners designed and equipped a complete refinery laboratory devoted to alkylate chemistry. Lab technicians are specially trained to analyse alkylate composition and quality, and to measure hydrofluoric acid purity using the Karl-Fisher titration test.

For additional HF activity tests, the lab is equipped with a fully enclosed glove box-type lab hood to confine any HF vapours. Any vapours released within the lab hood are neutralised through a caustic soda ash scrubber before they are vented.

The laboratory also analyses unit intake and discharge, water purity and ASO concentration and composition.

Emphasis on HF safety and control

'During the design phase and through construction of the gasoline complex, we worked to develop the very best safety procedures possible and we began our HF mitigation activities at an early stage,' Mr Rodrigues said.

The HF alkylation unit design includes elevated acid coolers and an acid storage tank that is lower than any other HF-containing vessels. This back-up acid storage tank, capable of holding all of the HF and hydrocarbons in the operating system, is part of the rapid acid transfer and vapour mitigation systems.

This design scheme uses a system of remote-control valves and HF's weight to control any potential accidental acid release by completely emptying the main reactor within 10 minutes. This fast response minimizes the amount of acid that can leak from the system, thus containing any HF emissions within the gasoline complex.

Space-age controls

Petrogal maintains complete control of the HF unit from a sophisticated computerised control room, located in a satellite building one mile from the complex. From here, operators monitor flow, temperatures, pressures and safety functions. Strategically located sensors on key valves, as well as hydrocarbon and acid detectors on the HF unit, provide operators with an early-warning leak-detection system.

Closed-circuit television throughout the complex compliments the computerised Honeywell TCD 3000 HF unit monitoring system. Four cameras, located at various levels and sites, monitor every major piece of equipment within thecomplex.

Safety measures here are some of the most sophisticated in the refining industry. For example, plant personnel use different types of protective clothing depending on their tasks in the HFA unit. Simple levels of protection include safety helmets with neck capes, visors, chemical goggles and neoprene gloves. More complex protection includes neoprene jackets and trousers, and full neoprene air suits pressurised by remote control breathing air compressors.

The entire complex includes high-capacity water deluge equipment to control any HF vapours. Critical pieces of alkylation unit process equipment were fitted with water spray nozzles and all alkylation unit process pumps were fitted with fire detectors and water spray equipment.

'We believe this is the safest, most economical HF alkylation system in the world,' Mr Rodrigues added.

Opportunity for growth

João do Nascimento Baptista, Director of the Ministry of Industry and Energy, said, 'Government's view is that environmental standards should not constrain economic growth. Environmental and economic targets must be adjusted accordingly.

'Portugal is now standing tall in EC markets with energy products to export. Petrogal is doing its part in supporting government energy, environmental and economic goals,' he added.

Hydrogen plant at Tosco Corporations refinery near Martinez, California

Refinery hydrogen requirements – 'make' versus 'buy'

By Professor Keith Guy, Marketing Director, Air Products - Europe and Mr Nico Steur, Marketing Manager, KTI bv

The market for refinery products is mature and faced with intense competition and increasing regulations. The key to survival is lowering costs and increasing flexibility. Hydrogen increases flexibility by allowing a refiner to react to market opportunities such as cheaper crude supplies and higher value transportation fuels and to meet clean fuel regulations. Having access to additional hydrogen can also result in less downtime and more production. The end result is higher profits!

Options

Past experience has shown that most refiners can justify additional hydrogen to boost output versus running in a hydrogen limited mode. Therefore, it is worth investigating every option to increase hydrogen availability. The four basic options are:

- Recover H_2 from offgases
- Expand existing capacity
- Build new capacity
- Buy H_2 from a third party

Offgas recovery typically results in only small quantities of additional hydrogen. Expansion of existing units within a refinery is worthy of analysis. Many refiners have opted to execute this option for their first stage in obtaining additional capacity. This paper will address the trade-offs between the last two options. New on-purpose capacity installed and owned by the refiner we will refer to as the 'Make' case option and purchasing hydrogen from a third party we will refer to as the 'Buy' case option.

Make case

Some refiners see advantages with the 'Make' case generally when the refiner wants total control of both the hydrogen project and ongoing supply. Of course the refiner needs to be prepared to devote the necessary capital and resources to ensure the project is successful. If a refiner can duplicate an existing plant, the 'Make' case could be the better option. However, the high efficiency and lower operating costs of a new plant should be factored in the analysis. There may be an ability to roll the hydrogen plant in with a larger hydrotreater or hydrocracking project to take advantage of synergies in execution. However, a new hydrogen plant is normally large enough in scope to stand on its own and may not receive the critical attention it deserves as part of a larger package. There may also be some special integration opportunities with utility systems or existing equipment but normally an onsite plant can mirror these. Finally, a refiner may perceive there are issues of their labour force co-operating with a third party but it is hard to justify a hydrogen premium for this in today's market. Whatever the reason, each refiner should look at his own plant and consider all other options before making a final decision.

Buy case

What the refiner gives up in control may be more than covered by the shared risk under the 'Buy' case, as a result of taking on a long-term partner, whose business is focused on producing hydrogen. In addition, there may be capital, energy and operating savings to the refiner. Even more importantly, there may be significant advantages as a result of sharing the output of a larger plant or being part of a multi-plant, multi-customer pipeline. The potential to gain that critical flexibility makes it a worthwhile consideration for the refiner.

Risk sharing

How does a long-term partner like Air Products reduce a refiner's risk? First, we provide the capital

Make vs Buy Analysis

Hydrogen Costs

Cost Category	Make case Typical Component	Improvement with Buy Case	Buy Case Typical Component
Capital	25-35%	5-10%	24-31%
Energy	65-50%	3-5%	62-48%
Operating (1)	10-15%	0-10%	10-13%
Total	100%-100%		96%-92%

(1) Labor, maintenance, chems & lubes, catalysts, site overhead

Overall H_2 price savings of 4% to 8%

and manage the project. If we overrun the project, it is out of our pocket because the price paid by the refiner is fixed up front. Even better, we are willing to offer a penalty/bonus clause on the project schedule to guarantee our performance. This is the reason we teamed up with KTI because they have the knowledge and track record of building plants on time. Once the plant is on-line, the company is also on the hook for efficiency and onstream performance. Finally, since operating costs are only adjusted for inflation, a refiner does not have to worry about exceeding the maintenance budget or the turnover of plant operators.

We view hydrogen not as a utility but rather as a focused strategic product line for the company, which we manage on an on-going basis to reduce costs and improve performance. For capital savings, the plant is designed to industrial gas standards, not refinery (API) standards. We spend money where it adds value for hydrogen production, not because it makes an FCC unit more reliable.

Operating

Controlling on-going operating costs can amount to significant hydrogen savings down the road. With the computerised preventative maintenance programme, failures and downtime can be minimised. By pooling the purchase of catalyst and other materials, large volume discounts not available to small purchasers can be achieved. Since insurance spare parts can be a major expense, our company keeps a central shared inventory that actually allows us to cover more equipment. We also provide maintenance and operating support on a centralised basis enabling us to reduce field staff. The end result is increased availability, which lowers the cost of each unit of hydrogen produced.

Hydrogen costs

Savings which can be achieved compared with a 'Make' case plant comprise:

- Capital 5 -10 percent
- Energy 3 - 5 percent
- Operating costs 0 - 10 percent

Overall, a refiner could see a 4 - 8 percent reduction in his cost of H_2. This may not sound like much but on a 50 million standard cubic feet/day H_2 plant, this equals $1.5 - $3.0 million per year.

Shared plant benefits

If a hydrogen plant can be located near two or more customers, a tie-in to a pipeline system can be made and a refiner can tap into even more savings. Since steam reformers do not scale down well, the larger the plant, the lower the product cost. Not only is the capital per unit less (25 - 30 percent) but the operating costs such as labour are spread out over a larger volume. A shared plant can also be located where it provides the greatest benefits to all parties (ie a lower cost for feed and fuel, a requirement for steam/power; availability of land and utilities). If several hydrogen plants can be interconnected, then reliability for all customers increases and there is even the chance of selling some hydrogen when you have an excess supply situation. Pipeline/shared plant customers have seen savings of 5 - 15 percent over a standard onsite and up to 25 percent over a 'Make' case.

Hydrogen plant at Total refinery in Flushing, the Netherlands

'South Africa has every chance of succeeding'

Mr R F (Pik) Botha, South African Minister of Mineral and Energy Affairs, addressed the 1995 Petroleum Dinner, organised by the IP Glasgow Branch.

He said in part:

The new government is only 10 months old. The old saying that 'The struggle continues' is a true one. Only now it is the struggle of the rule of law and the constitution, not the car bomb or the limpet mine.

The African National Congress (ANC), the National Party and others sometimes find it difficult to complete the move away from the past. We are still very much in the process of searching for common ground in South Africa. We have found some of this ground in the important area of fiscal and financial policy, labour relations and combating crime but we are having difficulty in deciding how to finance what we want to achieve and how to deal with the wounds and injustices of the past. To that extent we are still haunted by the past.

This is only human. It is to be expected. There would be something unnatural if the past were able to be left behind without some form of expurgation. We will need to be wise to allow it expression in a constructive and healing way. So there is still common ground to be found on how to come to terms with the past, its resentments and suspicions. The common ground is needed to wipe the slate clean, to put the noxious effects of past conflicts behind us.

We are still in the process of outgrowing historical anger and vested suspicions. These still erupt from time to time. Yet whenever the tension has escalated, our leaders have managed to rise even higher, seeking to understand the other's point of view.

Areas of concern

A powerful business organisation from one of the world's leading nations recently named three areas of concern in South Africa – violence and crime, antagonistic labour/management relations and political uncertainty.

The crime rate in South Africa is high. Our police force is recovering its morale. For years it found itself at the pit-face implementing the laws made by Parliament and ensuring the security of the state. It therefore became the focus of pent-up resentments. The establishment of community-based policing is taking root but it takes time to turn the ship around.

Crime will continue for as long as there is poverty and unemployment. We need economic growth, more jobs. It is as simple at that but it is not so easy to achieve.

Two major steps have been initiated to address labour/management relations. The first is the establishment of the National Economic Development and Labour Council. The second is a new Labour Relations Act which will facilitate and encourage constructive negotiation.

We have designed a Reconstruction and Development Programme which has the support of all the political parties in parliament. As regards fundamental rights, the constitutional Court has been launched. The Constitutional Court will ensure the individual protection against aggressive action by government at central, provincial and local level.

Energy resources

So far we have not discovered oil or gas resources of note.

But our energy position is much better than that bald statement would suggest. South Africa lies on a sea of coal which at the present rate of consumption will last for about 300 years. South Africa produces 180 million tons of coal annually of which 52 million tons are exported. So when existing oil resources are exhausted, South Africa will still have a few centuries of coal.

The question of pollution is a critical one for coal. We remove dust and ash particulates but still need to remove sulphur and nitrogen oxides. The sulphur content of South African coal is fortunately low, explaining the high demand worldwide for our coal.

Ninety-five percent of our electricity comes from coal. The remaining 5 percent comes from our nuclear power plant near the Cape, the only such plant on the African continent.

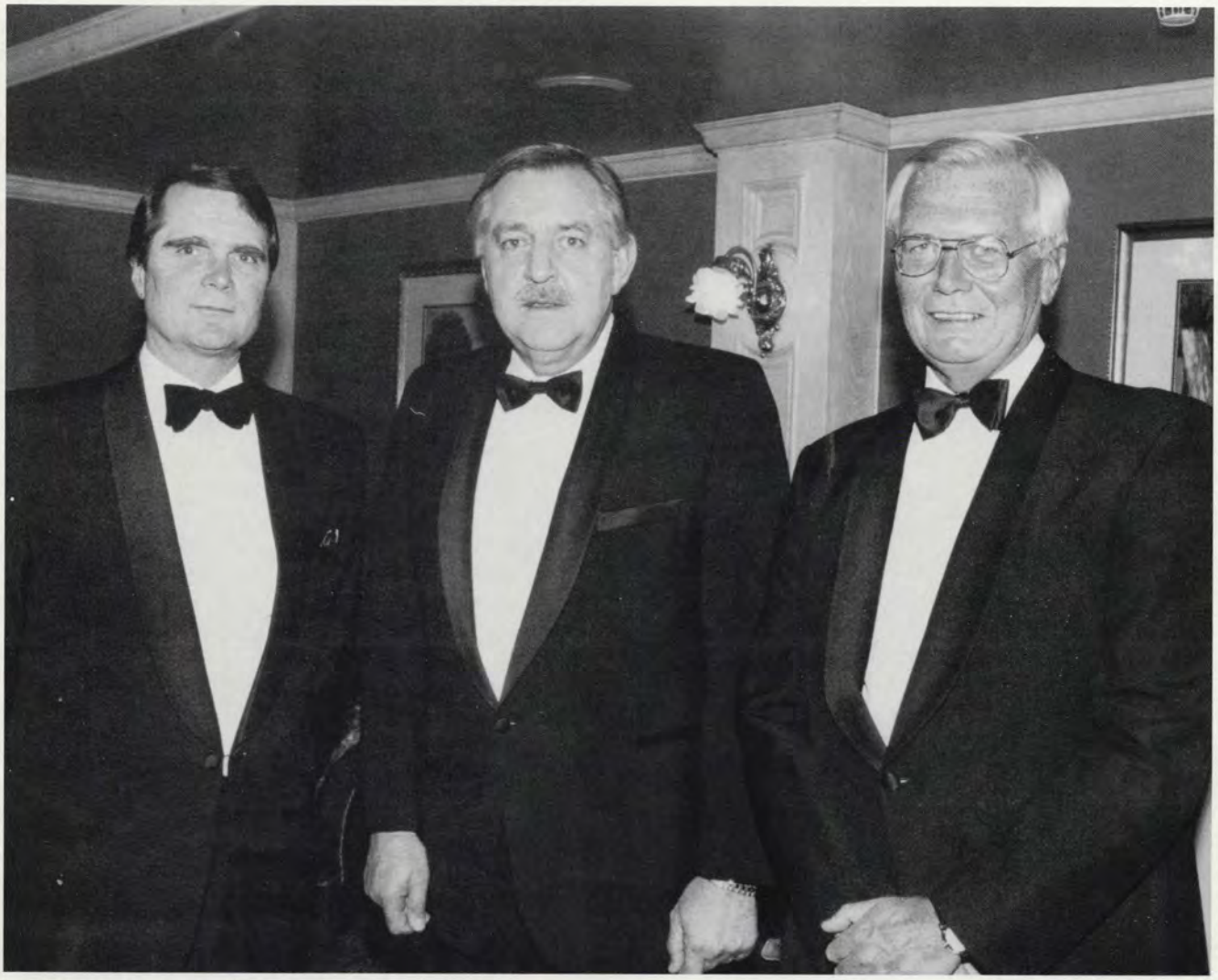
Around 35 percent of South Africa's liquid fuel requirements also comes from coal – coal of such low quality it can be called rubbish – while 40 million tons of this rubbish are used annually to produce synthetic fuel and petro-chemicals. This process is carried out by Sasol, originally a para-statal but subsequently privatised. Today it is one of South Africa's largest and most successful companies.

South Africa's International Offshore Licensing Round has received an encouraging response from the international oil and gas community. We are looking forward to co-operating with those who take up the challenge of searching for oil or gas off our shores. The Kudu and Pande gas fields off Namibia and Mozambique respectively, would seem to indicate that exploration along our own coasts could well be worth the inevitable risk and effort.

In the field of electricity a new National Electricity Regulator has been set up to rationalise the electricity industry. A new petrol price mechanism to respond on a monthly basis to international market changes is working well. Our strategic oil stocks have been reduced to four months' supply and will be reduced further, depending on the leasing of our storage facilities.

Moving ahead

What I am saying is that South Africa is moving ahead. We have a new government elected by all



Mr Heinz Rothermund, Managing Director, Shell UK Ltd, Mr Pik Botha, South African Minister of Mineral and Energy Affairs and Mr Keith Taylor, Chairman and Chief Executive, Esso UK plc.

our people. We have leaders of quality. We have established constitutional guarantees for our citizens. We have a credible fiscal and budget policy. We are in line with the successful industrial democracies of the world.

As we look towards the 21st century, we can only guess at the way in which the vacuum in international politics, left by the ending of the Cold War, will be filled. What seems sure is that there will be a major shift of power to the Far East.

In the meantime, three superpower constellations are coming into being – the Asian Rim, the European Union, and the North America Free Trade Association of Canada, Mexico and the United States. We in South Africa are asking ourselves: where do we fit in? We want to be a friend of all three superpower groups.

The greatest immediate challenge for all of us is the global economic disparity. In 1991, the richest fifth of the world's people enjoyed 84.7 percent of the world's Gross National Product; 84.2 percent of its trade; 85.5 percent of its domestic savings; and 85 percent of its domestic investment. By contrast, the poorest fifth starved on 1.4 percent of the world's GNP; 0.9 percent of world trade; 0.7 percent of its domestic savings and 0.9 percent of its domestic investment.

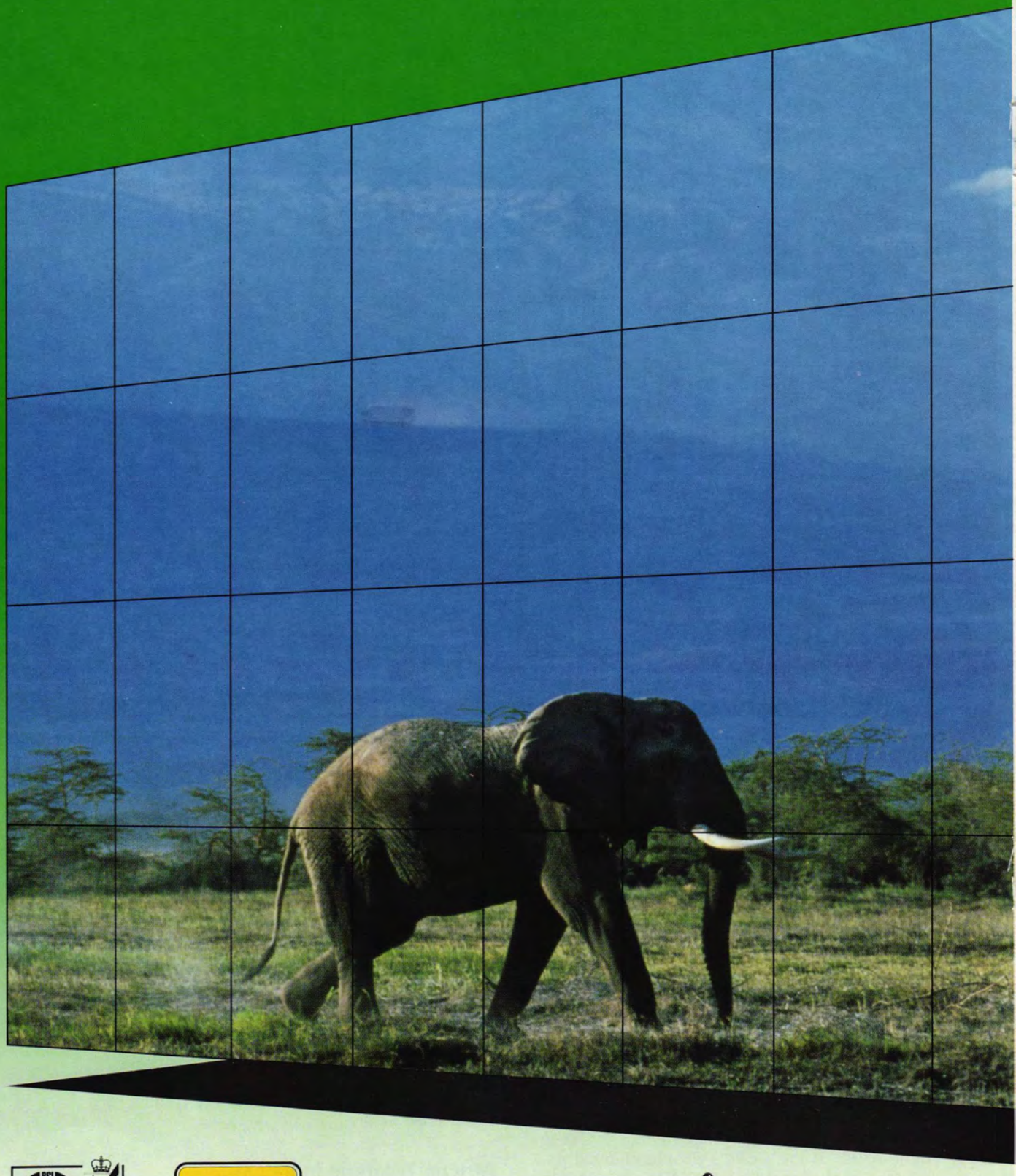
There is no way in which the richest one-fifth can escape this indictment.

My continent, Africa, is particularly pertinent in this respect. Africa is well represented in the poorest fifth which shares so little of the earth's bounty. It is a continent which stands on the sidelines watching as the giant economic blocs compete for world trade and the wealth that accompanies it.

The time has come when the successful nations must reach out directly to the suffering millions of Africa. There is also the necessity of waking up to the urgent need to ensure that South Africa remains a success story. For South Africa is the locomotive of Sub-Saharan Africa. Without a successful South Africa, Sub-Saharan Africa will slide even further into anarchy and misery.

African Trilateral Initiative

There is a way to reverse the trend. The economically developed nations should join hands with South Africa to form a triangular association with the struggling countries of Sub-Saharan Africa. Let us call it the 'African Trilateral Initiative.'



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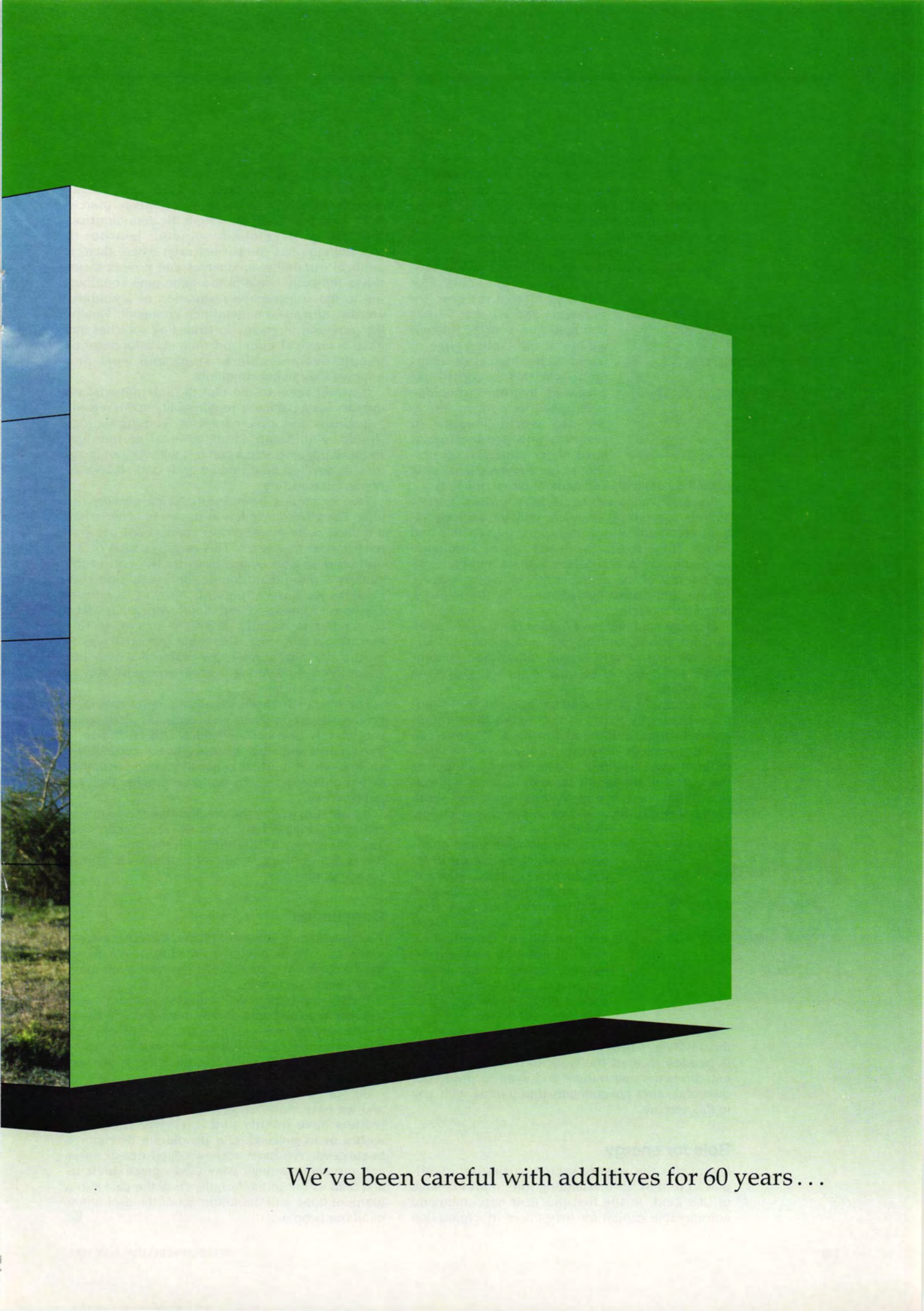

We've been careful with additives for 60 years . . .

Africa is an empty page. Great stories can yet be written on it. The continent needs a new beginning.

South Africa is the natural bridge for the process I am proposing. If things go wrong in South Africa, there is even less hope for Sub-Saharan Africa. That is why South Africa must succeed, not only within itself but also in relation to its neighbours.

And South Africa has every chance of succeeding. It has a bright future. Our gold and foreign reserves are increasing and stand at 12 billion rand (just over £2 billion); we are at the cutting edge of world technological development – with the additional advantage that our technology is designed to work in Africa; we are world leaders in reserves and production of most major minerals; 65 percent of our foreign exchange is earned by minerals and mineral-based products.

'So far we have not discovered oil or gas resources of note'

South Africa has substantial infrastructural assets – airports, seaports, its electricity grid, the banking system, communications, transport, universities and mines. These substantive assets can be maximised for South Africa, Sub-Saharan Africa and therefore for the rest of the world, if this initiative receives serious and urgent consideration by the industrialised democracies.

Development will have to take place as the result of joint public and private sector activity. The international private sector, rather than governments alone, should become major role players in this venture.

For example, a tremendous opportunity to produce electricity exists in the Congo River rapids between Brazzaville and Kinshasa. It alone can produce enough electricity for the whole of Africa without even building a dam. Pipes conducting the waters of the rapids through turbines will suffice. From there a grid leading north and south could service Africa and even provide electricity to Europe.

'South Africa is the locomotive of Sub-Saharan Africa'

At the moment some countries in Africa derive up to 90 percent of their energy from cutting and burning trees. Glasgow would not last long as a functioning city on that basis! Plants use sunlight to manufacture food. In addition they release oxygen, thereby counteracting pollution. Trees and plants should therefore be increased rather than cut down.

In the light of the considerable achievements of this Institute, I believe that your industry has what is needed to lead the way, to lead your fellow entrepreneurs and traders and even to prod your own and other governments into joining with you in this venture.

Role for energy

I consider the energy sector particularly well-placed to play an outstanding role in an initiative of this kind. In the first place, it can command considerable capital for investment in exploration and subsequent development where the nature and quantity of energy sources warrants it. Secondly, as long as there is peace and the tax regimes are stable, exploration for energy sources is not that dependent on a sophisticated infrastructure or a developed society. Lonrho in Mozambique has shown that even where there is political instability, companies can protect themselves militarily while at the same time contributing to the constructive restoration of a country. Thirdly, Africa is a mineral-rich continent. Finally, the provision of energy to struggling societies can have a magical effect on their development as people become able to study and work and improve their living conditions.

It would seem to me that the international oil industry has a particular responsibility in this regard.

Business and government of winning nations should, with South Africa as local partner and springboard, enter into a contract with African countries to develop their energy grids and socio-economic infrastructures.

Two examples from South Africa convey the idea. The government has as its aim to achieve half a million domestic electrical connections per year for the next five years. This means a total of 2.5 million domestic connections by the end of the century – more than double the 2.1 million connections we have at present. Also, in its current Offshore Licensing Round, South Africa has asked for tenders to include proposals for engineering bursaries at university. This is but one small way to ensure that the human raw material which lies latent throughout Africa is given an opportunity to realise its potential.

The African Trilateral Initiative is not a charitable venture, based on grants and hand-outs. Poor countries already owe outside lenders US$4.5 trillion in foreign debt and what has it really achieved? It is a venture which must be pragmatic, profit-orientated, driven predominantly by the private rather than the public sector.

It must also act on the premise that the supply of energy to Africa is basic to its revival. Energy is the key, energy is the lifeblood of any new era for Africa. South Africa stands ready to take its part in such a venture.

Conclusion

The nightmare of apartheid is over. We have entered a new era. We do not have a road map. We do not have a model. We are charting our way as we move across unknown terrain.

Parties who were at war with one another now sit together in a cabinet bound by a common loyalty to the country we love and share. We have problems: a high crime rate; burdens of the past; violence; inadequate housing; education; electrification; health services; unemployment; poverty.

But we have the means to tackle our deficiencies and we have demonstrated our will to do so. Our leaders have quality and integrity. The world wishes us to succeed. Our people are determined to succeed. We have acknowledged our mistakes and our shortcomings. May God's grace guide us and lead us out of the turbulence of the past into a future of hope and the fulfilment of the aspirations of all our people.

IP

THE INSTITUTE OF PETROLEUM

Introduction to Oil Industry Operations

Wednesday 21 June – Friday 23 June 1995

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- Participants from within the oil companies whose experience is limited to one function of the industry and who require a broader perspective of the industry's activities.

- Participants from financial and commercial institutions, other energy industries, analysts, suppliers, service companies and contractors; and government organisations who need an informed 'birds eye view' of the oil industry.

Topics to be covered during three days will include:

Changing perspectives in the International Oil Industry

Petrochemicals

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Marine Transportation

Exploration for Oil and Gas

Petroleum Production

Introduction to Marketing/Distribution/Retail Markets

Supply

Refining

This is a self-contained course but is followed by:

Introduction to Petroleum Economics

Monday 26 June – Wednesday 28 June 1995

This course is designed as a general introduction to the economics of the oil industry and may be particularly valuable to companies who do not hold their own in-house induction courses covering this subject. It is likely to be appropriate for:

- Participants from within the oil industry whose experience is limited to one function of the industry and who require a broader perspective of the economic factors affecting the industry.

- Participants from financial institutions, government, other energy industries and the supply and service industries who want to obtain an informed and concise introduction to the economic and commercial background to the industry.

Topics to be covered during the three days will include:

Geopolitics of Oil

OPEC/Middle East

Asia and Pacific Region

Eastern Europe and the Former Soviet Union

North America

North Sea Basin

The Oil Markets

Crude Oil Markets

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Vietnam ventures – building an oil and gas industry

By Terry Knott

With the announcement in March of a further offshore oil and gas discovery, Vietnam reconfirmed both its energy potential and a clear determination to build an integrated petroleum industry. The country's commitment to moving towards a market economy coupled with a favourable investment regime has established Vietnam as one of the most attractive new regions to open up to the international oil and gas industry in the past few years.

The latest hydrocarbon find was made by Total, encountering several oil and gas layers with its second well in the Nam Con Son basin, lying some 250 kilometres southeast of the country's oil centre at Vung Tau near Ho Chi Minh City. Following just a month after the BP-Statoil alliance announced it had found oil and gas further west, the news added to the momentum created by the half dozen discoveries made since last summer.

Bus fills up at Truong Dong, Mekong Delta. Photograph by BP Photographic Services/Caroline Penn

Run of discoveries

Mitsubishi subsidiary JVPC is appraising two reservoirs in shallow water relatively near to shore, which reportedly yielded one of the highest flow rates from a single production test in South East Asia. Malaysia's Petronas Caligari discovered significant hydrocarbon volumes in a similar location, while South Korea's Pedco consortium struck oil and gas in the adjacent block south of the Total find. Further out in the Nam Con Son basin, about 350km offshore, lie two large gas fields discovered by BP-Statoil in 1993, which with 350 million barrels oil equivalent rank equal to any other known field reserves in Vietnam.

The run of recent discoveries has brought renewed confidence that the country will be able to meet its production targets.

'Our aim is to increase oil production threefold to 20 million tonnes a year by the end of the decade,' said state oil company Chairman Dr Ho Si Thoang. 'By the year 2005 the forecast is for 30-35 million tonnes. With the finds over these past months we are optimistic that these targets can be achieved.'

Since Vietnam opened its doors to foreign investment in 1987 under its 'doi moi' policy of renewal and restructuring, almost 30 production sharing contracts have been signed between international consortia and PetroVietnam.

The first of these to come to fruition is the Dai Hung (Big Bear) field, originally discovered by Mobil in 1975 but left undeveloped when the United States withdrew from Vietnam in April that year at the end

of the war. Now operated by BHP Petroleum, the development came on stream last October in a record-setting 18 months. Output is currently around 30,000 barrels per day through the floating production platform Dai Hung 1 – formerly the Deep Sea Pioneer brought from operations in the North Sea and converted in Singapore. Reserves for the field have been downgraded since the original estimates and are now put around 200 million barrels, reflecting the complex geology of many of Vietnam's offshore reservoirs.

Dai Hung became the country's second producing oilfield, joining Bach Ho (White Tiger), a complex of a dozen platforms in the Cuu Long basin now producing some 130,000 barrels per day and in operation since 1986 under Vietsovpetro, the Vietnamese-Russian joint venture. The nearby smaller Rong (Dragon) field came on stream at the end of last year to add about 5,000 barrels per day, although this is expected to increase with the drilling of further wells in the basement reservoir structure.

The Dai Hung 1 floating production platform in operation offshore Vietnam. Photograph courtesy of BHP Petroleum

Significant gas potential

While oil has been the main focus of attention to date – crude oil accounts for about one-third of the country's export earnings – the discovery of more gas than at first anticipated is causing Vietnam to adjust its thinking on its future energy strategy.

Until now, gas produced offshore from Bach Ho has been flared but with the commissioning of a new $55 million 124km long 16in diameter pipeline to shore – installed last year by Hyundai – one million cubic metres/day of gas should start to flow in May to help fuel a 35MW power plant at Ba Ria.

British Gas with partner Mitsui is nearing completion of a joint venture for the Gas Utilisation Project which aims to harness natural gas from Bach Ho. The new pipeline is the first stage in this process; offshore, gas lift and gathering systems are being constructed and a contract award is expected soon for a new central compression platform – a key element in the plan – which will have initial capacity to handle all of Bach Ho's current production of around 4 million cubic metres/day. Onshore in its third phase, the plan calls for a gas processing plant to produce LPG, and a liquids storage and export terminal. The bulk of LPG production will be exported initially, as Vietnam's domestic market is small at present. In addition to fuelling Ba Ria, lean gas will also be used to power the Thu Duc power station, 70km away on the outskirts of Ho Chi Minh City.

Making best use of its gas resources has rapidly become a priority for Vietnam and will play an important role in shaping the country's energy infrastructure. The BP Lan Tay and Lan Do gas fields have sufficient reserves to fuel today's needs of Ho Chi Minh City – about 1,200MW – for at least 25 years. At the end of March several operators with offshore interests in the vicinity of the fields – BP, Statoil, BHP and Mobil, along with PetroVietnam – signed a co-operation agreement to carry out a feasibility study on the construction of a gas processing and transportation system to serve the region. Determining an economically viable solution for bringing the gas ashore and optimising its use – for example in power generation, LPG and fertiliser production – is a critical step in developing the area lying 350km offshore in water depths up to 180 metres.

Gas Master Plan

At a national level, the British government confirmed funding in March of $2 million to support Vietnam in developing a Gas Master Plan for the year 2010. BP, British Gas and UK consultant Mott Ewbank Preece, with assistance from Mobil, will work with PetroVietnam and a number of Vietnamese ministries under the guidance of the State Planning Committee.

'Over the next 12 months we intend to develop a strategic framework which will help support and initiate future projects,' explained Alastair Ferguson of BP, Project Manager for the master plan. 'The Cuu Long and Nam Con Son basins together could hold up to 280 billion cubic metres of gas, some think possibly more. In the central region offshore Danang there is gas, which may be in sufficient quantities to overcome the problems caused by carbon dioxide being present. Small quantities of gas are already being

BP is one of the first international oil companies with a successful lubricants joint venture in Vietnam

produced onshore in the North. It is clear Vietnam has an abundance of gas – the objective of the master plan is to review supply and demand and determine how best to utilise this important resource through the whole value chain, upstream, midstream and the creation of a downstream market.'

Downstream market

Vietnam's annual market for petroleum fuel products is estimated at 4 million tonnes at present but growing rapidly and should at least double over the next five years. All crude oil is currently exported but plans for the country's first refinery, with a capacity of 130,000 barrels a day and an estimated cost of $1.2 billion, are at an advanced stage, and a second refinery is under discussion.

Downstream markets come under the jurisdiction of the Ministry of Trade. While fuel distribution and retailing are not yet open to foreign oil companies – Petrolimex is the largest of a handful of state companies supplying 1,170 of the country's 1,800 retail outlets with some 70 percent market share – import, production and sale of lubricants is an open and growing business sector, in which BP, Castrol, Elf and Shell are among the leading joint venture players, with Caltex, Esso, Mobil and Total also present.

Mushrooming lubes business

Demand for lubricants is currently some 100,000 tonnes per year, the bulk of which is used in the south of the country. As vehicle numbers increase, familiar oil company logos are appearing on most streets to service the growing fleet of trucks, cars and mopeds. Traffic in the capital Hanoi and in Ho Chi Minh City has mushroomed over the past few years and an estimated quarter of the southern city's 4.5 million inhabitants now move around by moped.

Castrol set up the first lubes joint venture with SaigonPetro with its lube oil blending plant coming into operation in 1992 near Ho Chi Minh City, believed to be producing at about half of its capacity of 25,000 tonnes/year. Elf is blending marine lubricants at one of Petrolimex's three plants at Nha Be terminal near Ho Chi Minh City.

BP received a licence for its $28 million joint venture with Petrolimex in August 1992. Known as BP Petco, the company now has 80 employees and produces 20,000 tonnes of lubricants a year at a refurbished Petrolimex plant at Nha Be. BP Petco has also begun construction of a new blending facility at Nha Be which will be completed in 18 months time with a capacity of up to 50,000 tonnes/year.

Shell is negotiating a joint venture with PetroVietnam which intends to build a new blending plant at Dong Nai, north east of Ho Chi Minh City with an initial capacity of 25,000 tonnes/year. In anticipation of the joint venture, Shell has leased a 10,000 tonnes/year plant to PetroVietnam's Vidamo lube oil subsidiary, and already imports about 5,000 tonnes of its products to the market.

Taken together, international oil company joint ventures supply about 50 percent of Vietnam's lubricants, mainly at the top grade end of the product market. The remainder is provided by small companies licensed by local committees which tend to market low grade lubricants under less strict controls. Recent tax increases on imported base oils from 1 percent to 7 percent, intended to squeeze low grade products from the market, have tended to encourage 'rogue' blenders to use other low grade oils which still attract the old duty rate. To tackle this, Vietnam issued a minimum specification in January which stipulates technical standards, labelling, import licence regulations and registration requirements. 'The right moves are being made,' said one oil company chief executive.

Outside the lubricants market, Shell already supplies Petrolimex with bulk bitumen from Singapore and has a joint venture with two other companies which is now beginning construction of a bitumen storage terminal at Vinh in the north. Road quality in Vietnam is generally poor, with only about 10 percent of the country's 87,000km of roads being paved, hence there will be a long-term demand for bitumen.

But perhaps the larger prize which oil companies seek is access to main fuels retailing, diesel and petrol. Many see the step of establishing lubricant outlets as the springboard for the larger market, when and if it is opened to competition. Shell – which sold its first tin of kerosene in Vietnam in 1894 and held 70 percent of the retail market until 1975 – is keen to see the current position change.

'Shell studies show the current distribution network is incapable of meeting the consequences of volume growth rates of 10 percent – perhaps 15 percent or more – which are likely in most petroleum products in the next five or 10 years' says Howard Gatiss, General Manager for Shell downstream operations in Vietnam. In the company's view, retailing and distribution in Vietnam are ready now for reshaping, supported by the introduction of new capital and international expertise and the need for careful planning to account for national and provincial priorities and Vietnam's peculiar geography.

Lube oil outlets and bike washes are first steps for foreign companies in the downstream market. Photos by Terry Knott

Resource access concerns oilmen

By William Scholes

The potential for political actions to override straightforward decisions concerning resource access is the biggest challenge for the Australian petroleum industry in 1995-96, according to Mr Bernard Wheelahan.

Vice Chairman of the Australian Petroleum Exploration Association and Executive Director – Upstream Oil, Natural Gas and Coal, Shell Australia Ltd, he was addressing delegates to the 35th Annual APEA Conference held in Adelaide.

'Australia's most valuable industry was entering another upward turning point'

'It is a particular challenge to ensure that the industry has access to prospective areas for exploration and development,' he said. 'Forthcoming elections in 1995-96 have the potential to politicise what should be straightforward decisions concerning marine access based on principles of multiple land use.

'The principles of multiple land use are well established in Australia and overseas. However, it needs people of goodwill, honesty and integrity to apply these principles more widely.'

He noted that Australia's most valuable industry was entering 'another upward turning point.' 'There are tremendous opportunities ahead of us in the Australian oil and gas scene. These are exciting times indeed for all of us,' he said.

Gas growth

Privatisation and massive growth in gas-fired power generation was creating a new world order in the oil and gas business, Mr James Crump of Price Waterhouse told the conference. He said that the global privatisation push reflected economic pressures. 'The developing producing states, by and large, have spent their crude oil profits on massive social, educational and political projects,' he said.

'With crude oil prices essentially in decline since 1980, they desperately need an infusion of capital to continue social programmes, to reduce debt and to upgrade facilities and technology to meet higher revenue goals for both oil production and internal use,' Mr Crump said.

Privatisations would see reformist governments 'kick out the sagging props from under state-run oil and gas enterprises and phase out unrealistic subsidies for petroleum products'.

He identified the surge in gas-fired power generation as a sea change for the industry. He said that gas as a feedstock would grow at the 'astounding' rate of 10.3 percent per annum, more than any other fuel.

For instance, in south Asia, gas would become the major power feedstock, growing at 8.4 percent annually until 2010.

Mr Crump said that an increasing number of oil companies were making direct investments in gas-fired power generation, including BHP with its proposed $A1.2 billion power project with Bolivia's and Chile's state-owned oil companies.

Tax exceeds profit

APEA Chairman and Ampolex Managing Director Dr Peter Power said that the gulf between shareholder risk and government reward was a major challenge to the continuing development of Australia's oil and gas reserves.

He revealed that for the fifth year in a row, Australian taxes exceeded industry profit. 'This outcome is not sustainable if Australia wishes to maintain a robust exploration and production industry,' Dr Power told delegates.

The annual Financial Survey of members undertaken by APEA showed that direct government taxes levied against the petroleum exploration and production sector totalled $A2.19 billion in 1993-94, compared with a net industry profit of $A1.95 billion.

'Governments need to realise they are in competition for exploration risk dollars just as much as the companies are for prospective acreage,' Dr Power said.

He said that industry efficiencies and new technology had played a major part in countering the impact of taxes, low oil prices and resource access hurdles. 'We also provided more than 7,000 direct jobs, which would at least double when you take into account the various activities in support industries,' he said. 'In addition, the industry has an $A8 billion impact on the balance of trade and an environmental record of which we are justifiably proud.'

He added that petroleum's status as the most valuable commodity produced in Australia and its 53 percent share in providing the country's energy requirements, made it vital for energy security that an equitable partnership be struck between the private and public sectors in developing oil and gas reserves.

He said that governments must be prepared to share the risks which confront the industry in developing resources. They must structure taxes so that revenue objectives did not override the focus of maintaining a fiscal regime which encouraged risk capital to be spent in Australia pursuing the considerable potential for oil and gas.

'Australia's petroleum exploration and production sector maintained a stable balance sheet in 1993-94'

Equally important was the need to ensure that access to prospective acreage was facilitated on reasonable terms. Uncertainties arising from debates over marine access, heritage access, Mabo native land title legislation and environmental impact assessment procedures all worked against the creation of a transparent and predictable framework in Australia.

Despite continuing low oil prices, disproportionate taxation rates and uncertainties relating to resource access issues, Australia's petroleum exploration and production sector maintained a stable balance sheet in 1993-94, according to the APEA Financial Survey. This showed that a continued weakness in oil prices led to significant fall in gross operating revenue in 1993-94, compared with the previous financial year.

A fall in the overall level of taxation coupled with reductions in operating costs, helped to stabilise net profit performance at $A1.95 billion. Government revenues from the sector totalled $A2.42 billion.

New licensing round

Federal Resources Minister David Beddall announced that applications were invited for the award of 13 offshore petroleum exploration permits on the Australian continental shelf.

Six of the areas are off the west coast, three in the Territory of Ashmore and Cartier Islands, two off the south coast and two off the coast of Victoria. Applications have to be lodged before 5 October. Exploration permits would be awarded for an initial period of six years.

This is the first acreage release for 1995. 'Although the areas have been the subject of exploration in the past, additional work is required to assess their petroleum potential fully,' Mr Beddall said.

The minister commended APEA for participating in a programme with the Energy Research and Development Corporation. A sum of $850,000 would be allocated over three years for further research on the impacts of offshore petroleum activities.

The number of wells drilled in Australia had recovered slowly from 115 in 1991-92 to 134 in 1993-94. Although forecasts indicated a plateau in drilling activity in 1995, the offshore activity remained healthy.

Capital expenditure in petroleum exploration and development has also increased significantly over the last three to four years and was estimated at around $A2-2.5 billion in 1993-94.

The government recognised that it must create an environment that was internationally competitive if it was to attract and retain oil industry investment domestically. But this did not mean companies should concentrate all of their resources in Australia.

'I am aware of a view in the industry that Petroleum Resource Rent Tax (PRRT) is good for oil but not good for gas developments. If the industry considers that the PRRT arrangements for gas projects inhibit the development of otherwise commercial projects, I would welcome detailed evidence in support of this contention,' he said.

The Federal Government would listen to the arguments and consider action to facilitate LNG projects if justified.

Where excise was applied, the Federal Government was currently discussing with industry options for streamlining administrative arrangements. These changes should be of benefit to industry.

Australia had been at the forefront of industry technology developments and had been one of the leaders in applying floating production and storage facilities and subsea completions. BHP Petroleum's methanol and LNG development work held promise of new horizons in improving the commercial prospects for small gas fields.

Mr Beddall said that the development of guidelines covering the development approval process for offshore petroleum projects was nearly complete. These would give industry greater certainty on which they can base their investment decisions. APEA has provided a very constructive input to these guidelines.

Another issue on which the government has been consulting with industry had been the review of the Petroleum (Submerged Lands) Act. The objectives were to streamline the legislation, to minimise unnecessary red tape and to modify other arrangements where appropriate to facilitate exploration and development.

The minister also told delegates that he had commissioned a review of the effectiveness of government activities in promoting Australia's offshore petroleum exploration acreage. To date over 6,600 wells have been drilled in Australia. This was very small compared with over 3 million wells drilled in the United States. There is, he said, still great potential for further exploration and petroleum discoveries in Australia. Vast areas of the continental shelf have only been explored lightly and there were others that had not been explored at all.

Natural gas vehicles - a realistic alternative

By DC Carslaw and N Fricker, British Gas Research and Technology

Road vehicles are now the principal source of air pollution in urban areas in the United Kingdom. Environmental concerns over road transport are no longer restricted to the control of impacts at the point of use. It is now recognised that the impacts are local, regional and global in nature. A comparison of the impacts that different fuels have on the environment must therefore recognise the scale over which they occur.

In urban areas, where human health concerns are important, road transport typically contributes between 70-90 percent of the total emissions of several key pollutants. In fact the contribution made by road transport to urban emissions is greater than for national emissions. This is of concern since, unlike emissions from industrial chimney stacks, vehicle emissions are released at ground level where there is the potential to do most damage.

The renewed interest in the links between air pollution and health has highlighted several key pollutants for which there is increasing evidence of adverse health effects at ambient concentrations. These pollutants are nitrogen dioxide (NO_2), fine particulate matter and ground level ozone. In particular, there have been several studies which have shown that there is convincing evidence of a link between low concentrations of particulate matter less than 10 μm diameter (PM10) and increased death rates. Ambient air quality standards have also been proposed for two carcinogens – benzene and 1,3-butadiene.

There is also growing concern that man-made emissions of carbon dioxide (CO_2) and other greenhouse gases may lead to global warming. The road transport sector is the fastest growing sector for CO_2 emissions. Indeed, according to government projections, the transport sector in the United Kingdom is expected to contribute some 70 percent of the projected increase in total CO_2 emissions between 1990 and 2000. A 17.5 percent reduction in projected CO_2 emissions from the transport sector in 2000 would return transport CO_2 emissions to their 1990 level, whereas a 25 percent reduction would return *total* UK CO_2 emissions to their 1990 level

Natural gas vehicles

Over one million vehicles are now operating on natural gas on the world's roads. Most are to be found in areas with an indigenous natural gas supply and having suffered (or being vulnerable to) interruptions in supplies of oil-based fuels (this latter category includes the United States). However, the major growth in NGV numbers is likely to occur in regions suffering environmental problems associated with the use of road vehicles. Urban areas in Europe and the United Kingdom fall clearly into this category. Natural gas has excellent credentials as a cleaner road vehicle fuel, and the main purpose of this paper is to present evidence of the nature and extent of these benefits.

NGVs may be refuelled in fast-fill (directly analogous to the normal filling practice for petrol and diesel vehicles) or slow-fill mode. The latter system allows vehicles to be refuelled over a period of several hours overnight, including the option for refuelling private vehicles overnight from low pressure domestic gas supplies.

Although many major vehicle manufacturers in the United States and Europe are now introducing OEM (original equipment manufacturer) NGV products into the market-place, their relatively limited availability has meant that most NGVs currently in circulation are 'after market' conversions of petrol and diesel vehicles. Furthermore, despite a considerable level of investment in the refuelling infrastructure (particularly in the United States where fast-fill stations are opening at the rate of about two or three a week), the current limitations on filling-station numbers means that most light duty vehicles are converted to operate in bi-fuel (spark ignition engine, operating on natural gas or petrol at the driver's choice) or dual-fuel (diesel cycle based on a mixture of natural gas and diesel oil) modes.

In the United Kingdom, British Gas has taken the initiative setting up a 300 vehicle trial in its own fleet based around eight fast-fill refuelling stations distributed throughout the country. Local NGV centres have been set up in Manchester, Leicester and Slough in addition to the eight refuelling stations at Livingstone, Warrington, Dudley, Loughborough, Bristol, Slough, London and Southampton. A comprehensive research and development programme has been set up at the company's Gas Research Centre in Loughborough.

The early focus of NGV activities in the United Kingdom has been the 'after market' bi-fuel conversions of car derived vans and panel vans. The remainder of this paper considers the environmental consequences of converting the modern (catalytic) versions of such vehicles to bi-fuel natural gas operation.

Emissions from NGVs - comparisons with conventional fuels

Test cycles emissions

The emissions testing was performed on two 1.4 litre Escort vans fitted with three-way catalysts designed to meet all current EU tailpipe emissions limits when operating on petrol. For petrol, the emissions data were taken before conversion to operation on natural gas to eliminate any possible effects of the conversion kit. The vehicles were tested twice on each fuel giving a total of eight tests. The tests were carried out at establishments that have facilities which are accredited for certified European Union (EU) emission testing.

Comparing the emissions from different vehicles is

Table 1: Emissions of Legislated Pollutants Over the Standard EU Test Cycle (g/km)

Pollutant	Petrol	Natural Gas	EU Limit (Directive 91/441/EEC)
THC + NO_x	0.50	0.24	0.97
CO	1.54	0.90	2.72

difficult because of the number of factors that have an effect including engine size, driver behaviour, control technology and ambient temperature. In order to compare emissions from vehicles it is desirable to eliminate as many of these factors as possible. For this reason, vehicle emissions are generally measured over standard test cycles on rolling roads that attempt to simulate typical driving patterns. Average results from the Escorts shown above demonstrate the advantage NGVs have in terms of legislated pollutants for the EU test cycle.

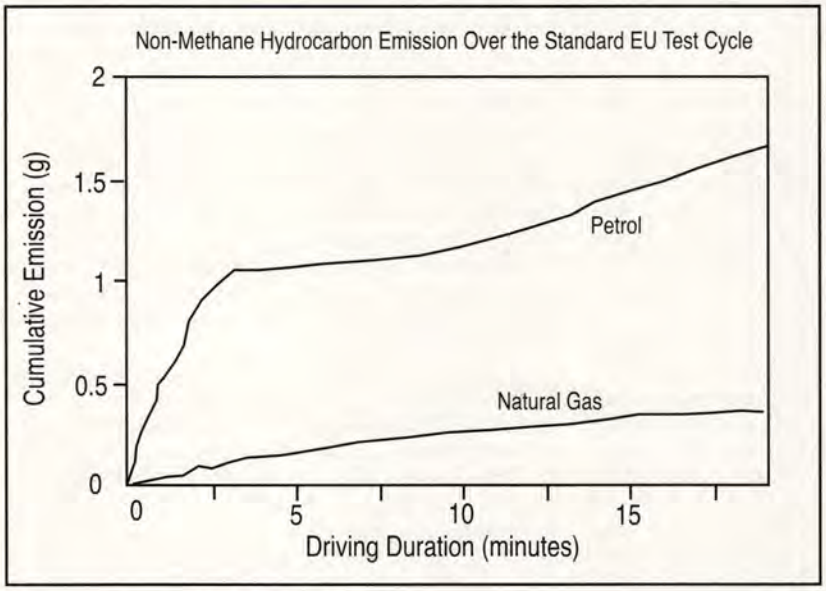


Figure 1

Urban driving

When comparing emissions over the standard test cycle it is important to understand two factors which can affect the emissions from vehicles:

1. The analysis process begins 40 seconds after the engine is started, resulting in considerable unmeasured emissions.

2. The test procedure is carried out at between 20° C and 30°C (typically 25°C), which is not representative of average temperatures in the United Kingdom which are nearer 10°C.

The second point is important for petrol vehicles, since unlike NGVs, they require cold start enrichment to start, especially at low ambient temperatures.

An assessment has been made of the emissions expected under typical urban driving conditions. Consideration has also been given to unlegislated pollutants such as benzene, 1,3 butadiene and the potential of exhaust components to form ground-level ozone. This has been done by interpreting the results from the EU test cycle in a way that better reflects urban-type driving.

Using the cumulative emissions over the EU test cycle, the emissions can be expressed as a function of time or distance as shown in Figure 1. The graph shows that in the first 10 minutes (3 km) the petrol van emits a total of 1.20g of non-methane hydrocarbons (NMHCs) compared with 0.26g on gas. Over a shorter distance of 0.5 km the petrol emissions go up to 2.0 g/km but are only 0.22 g/km on natural gas, demonstrating the cold start advantage that NGVs have. This information can be used together with the National Travel Survey data to express emissions as a function of trip length.

Although experimental results were only available for vehicles running on petrol and natural gas, typical diesel vehicle emissions data were taken from other published sources for comparison. Data were taken from the CORINAIR (1993) study for diesels below 2.0 litres for typical vehicles in 1990. For this reason a direct comparison on the same basis is not possible, however, the diesel emissions data used is thought to reflect those expected from a modern diesel vehicle.

The analysis reveals that the EU test cycle results underestimate the benefits of a change from petrol to natural gas. The reductions achieved in CO and hydrocarbons are over twice those suggested by the EU test cycle. More importantly, the emissions of pollutants of most concern are very low indeed. NO_x is only 17 percent of petrol and 20 percent that of diesel, benzene emissions are less than 3 percent of either petrol or diesel and 1,3 butadiene was too low to be detected from the NGV exhaust. Although particulates were not measured, the amount from NGV exhaust is very low compared with diesel vehicles. Another significant advantage of NGVs is their very low potential to form ground level ozone as a result of the very low reactivity of the hydrocarbons in the exhaust. (Figure 2).

Winter pollution problems

Under certain weather conditions the concentrations of many pollutants can be very high. In winter, during anticyclonic conditions of low wind speeds and inefficient atmospheric mixing, the concentrations of pollutants can exceed international health guidelines by a considerable margin. Two notable pollution episodes, one in London in December 1991 and the other in Birmingham in December 1992 illustrate this point well.

During both episodes there was evidence of an increase in the incidence of several adverse respiratory effects. Furthermore, in London there is some evidence that the death rate increased.

Vehicle emissions are very temperature dependent and at low temperatures emissions from petrol vehicles in particular increase greatly. Taking petrol emissions of CO as an example, the emission is some *three* times that from the standard EU test cycle, a trend that is seen for most other pollutants. The advantage NGVs have under these conditions are clear, and support the view that under the most polluting conditions

they have the greatest potential to reduce the pollutants of most concern.

Global warming

The greenhouse effect has received widespread attention in the scientific and popular press. Without the natural warming effects of CO_2 and water vapour, the Earth would be about 30°C cooler than it is today. However, the concern in recent years is that man-made emissions of greenhouse gases will lead to an *enhanced* greenhouse effect and global warming. A comparison is made between NGVs, petrol and diesel vehicles below.

Different greenhouse gases have different warming potentials that depend on their radiative properties and their lifetime in the atmosphere. A gas such as methane is a more powerful greenhouse gas than CO_2 but has a shorter lifetime in the atmosphere, meaning that it has a reduced effect with time. As well as having a direct warming effect, methane reacts in the atmosphere to form other greenhouse gases such as CO_2 and ozone, thus having indirect effects that must also be taken into account.

The Intergovernmental Panel on Climate Change (IPCC) has developed a method of comparing the warming effects of different greenhouse gases. The global warming potential (GWP) of a gas is defined as the warming effect of 1 kg of a gas compared with the warming effect of 1 kg of CO_2. GWPs can be expressed over different time periods, although the optimal period considered by most is 100 years. The GWPs used in this paper are given below, based on the 1990 and the 1992 IPCC assessments.

GAS	GWP[1]
CO_2	1
CH_4	22
Non-Methane Hydrocarbons	11
CO	3

[1]IPCC in thier 1994 update have increased the GWP of methane to approximately 27. This update will only have a marginal effect on the assessment made here.

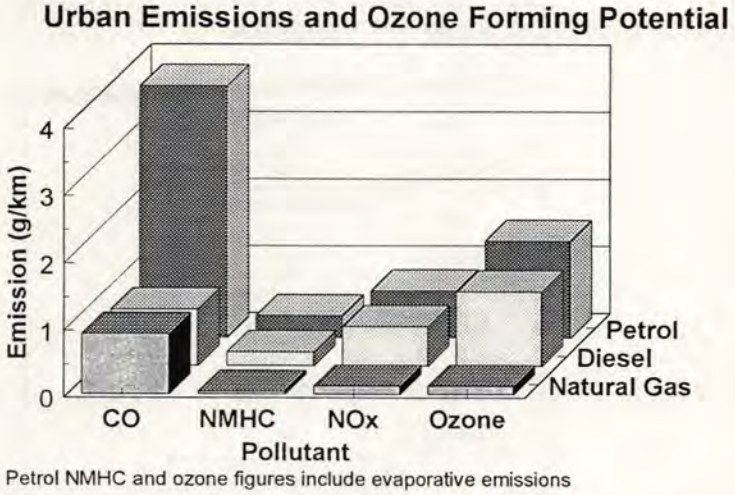
Table 2: Global Warming Potentials

The total impact from the release of greenhouse gases can be expressed as a CO_2-equivalent using the GWPs above. For example, if 100g of CO_2 was released together with 1g of CH_4, the CO_2-equivalent would be (1 x100 + 22 x 1), 122g. This allows the emissions from different processes to be compared in a similar way.

Fuel cycle emissions

When making global warming comparisons it is necessary to take into account all the upstream emissions – from the extraction of the primary fuel to point of use.

A longer-term view has been taken of the emissions and fuel economies of the vehicles based on a literature review of advanced control vehicles ie. those that have been optimised for a particular fuel. For this reason NGVs are assumed to have a 10 percent fuel economy advantage over petrol vehicles.



Petrol NMHC and ozone figures include evaporative emissions

Figure 2

Emissions comparison

Both natural gas and diesel have a significant advantage over petrol. The 19 percent reduction in greenhouse gases from NGVs compared with petrol vehicles is therefore significant given the estimated 25 percent reduction required in the year 2000 to reduce total UK CO_2 emissions to their 1990 level.

It could legitimately be argued that methane leakage from the distribution system should not be apportioned to NGVs. This is because the use of natural gas for NGVs will not give rise to any (or at least insignificant) additional emissions of methane from the transmission and distribution of gas, since the rate of methane loss from existing gas pipelines is not affected by the throughput of gas they carry, and any new lines needed for NGV supply would have a much lower leakage rate than existing cast iron mains. This would further increase the advantage NGVs have.

External costs of road transport emissions

The UK government has stated its commitment to using the market to stimulate a change in behaviour towards more environmentally sustainable practices. Although it has yet to develop a policy on economic instruments eg. taxes, subsidies, pollution charges etc., it is clear that such an approach will only succeed if market prices adequately reflect all of society's concerns.

In the case of the environment, it is very difficult to translate concern into monetary units. However, there are an increasing number of attempts to determine the external cost, ie. those not included in the market price, associated with the environmental impacts of energy production, supply and use, including the transport sector.

There are many uncertainties surrounding methods to determine the external costs of transport fuels. First, there is the uncertainty in determining the amount of an emission released. Then, there is the uncertainty in assigning an economic value to an environmental impact – to date the environment has been considered as a 'free good'.

In their 18th report on Transport and the Environment, the Royal Commission on Environmental Pollution highlighted the very sub-

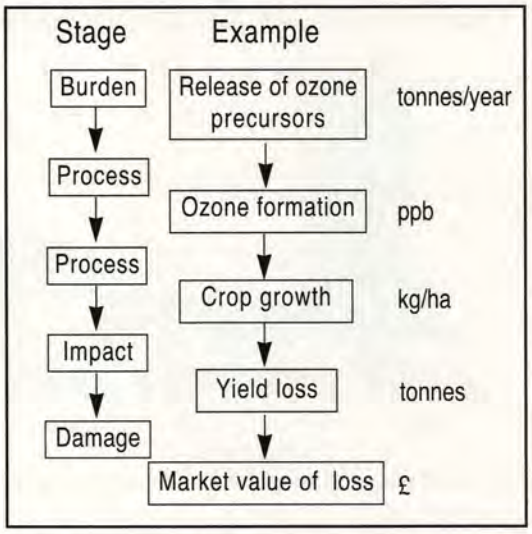


Figure 3

stantial environmental costs of road transport. In that report it was estimated that the environmental costs are between £4.6 billion and £12.9 billion or between I and 2 percent of GDP (Royal Commission on Environmental Pollution, 1994). Most of the studies that these figures are based on have, however, been extrapolated from studies in other countries.

At present the methodologies for external costs are still being developed and are open to large uncertainties in the absolute values of the numbers they generate. They do however provide a means of comparing the relative costs of different fuels based on the most up-to-date information available.

As a contribution to the debate, British Gas commissioned a study by an independent consultant to estimate the external costs of petrol, diesel and natural gas in the United Kingdom. The study was carried out by Eyre Energy Environment (EEE) and Economics for the Environment Consultancy (EFTEC).

The aim of the methodology is to relate the emission of a pollutant to an impact and a monetary value based on a 'willingness to pay' to protect human health and the environment from changes due to pollution. An example of the stages involved in the valuation of a release of ozone precursors ie. NO_X and hydrocarbons is shown in Figure 3. For the impacts on health and buildings, which make up most of the external costs of the liquid fuels, the valuation is based on real markets and is less susceptible to methodological uncertainty than other valuation techniques.

The link between the concentration of a pollutant and its effect, as well as the valuation of impacts, have been derived from previously published studies using established state of the art techniques from environmental economics (CEC, 1994). The application of air pollution dispersion models to make the link between emissions and concentrations is new and has been developed for this study by EEE.

Table 3 summarises the major impacts considered in the study along with the pollutants in each case.

The results in Figure 4 demonstrate clearly that natural gas has a lesser environmental impact in all categories spanning local to global concerns, when compared with petrol and diesel fuelled vehicles. It should be pointed out that the health impacts are the most important for petrol and diesel, which are a result of the primary or secondary particulates formed from the exhausts of these vehicles.

Impact/Effect	Pollutant	Comments
Global warming	CO_2, CH_4, nitrous oxide (N_20)	Based on a CSERGE assessment of the social costs of global warming and includes loss in agricultural production and costs of building sea walls etc.
Acid deposition	Sulphur dioxide (SO_2), NO_X	Results in loss of crops and forests (timber), also results in acid attack of buildings and historic monuments.
Health[1]	Particulates (PM10, including secondary sulphate and nitrate)	Based on 1% increase in mortality for each 10 μgm^{-3} increase in PM10 (Quarg, 1993) and morbidity costs (medical expenses, work days lost etc.)
Urban soiling	Particulates	Economic cost of building cleaning

[1] The statistical value of life, which is the main determinant of the health values is assumed to be £2 million, is widely agreed by economists to be within a factor of three

Table 3: The Impacts of Road Vehicle Emissions

The External Costs of Vehicles in Urban Areas

The low cost estimate for NGVs in urban areas supports the view that they emit very low amounts of the pollutants that do most harm.

The costs can also be expressed in terms of pence/litre from the fuel economies assumed in urban areas (petrol and natural gas 10.2 litres/100 km petrol equivalent and diesel 8.2 litres/ 100 km):

Petrol	10 pence/litre
Diesel	21 pence/litre
Natural gas	2 pence/litre (petrol equivalent)

Although there are uncertainties in the absolute values of the external costs, the relativities between petrol, diesel and natural gas are much firmer and only depend on the emission factors used.

Conclusions

Technology is now available to run many categories of road vehicles on natural gas. NGVs represent a practical solution to environmental problems caused by road transport on local, regional and global scales. Even when using the comparatively simple technology available today to convert petrol vehicles to run on either natural gas or petrol, impressive reductions are seen in the amounts of pollutants emitted. Of particular note is the substantial reduction in the emissions which are currently of most concern in urban areas; namely nitrogen oxides, fine particulate matter and benzene. In addition, the low reactivity of NGV exhaust gases ensures that NGVs have a very low ozone forming potential. Under urban-type driving conditions the following reductions were observed:

- 77 percent reduction in NO_X compared to petrol and 80 percent compared with diesel
- 76 percent reduction in CO compared with

petrol

- Over 97 percent reduction in benzene compared with either petrol or diesel
- Approximate 90 percent reduction in ozone forming potential compared with petrol or diesel.

In addition, under the conditions of a winter pollution episode, where ambient concentrations of pollutants exceed health guidelines by a significant margin, NGVs are shown to have even greater advantages.

Even when taking into account the full fuel cycle emissions of methane, dedicated NGVs have a global warming impact 19 percent less than petrol vehicles. The widespread use of NGVs would therefore support the United Kingdom in meeting its international commitments for reducing greenhouse gases.

An independent study commissioned by British Gas clearly shows that the external costs associated with emissions from NGVs is far less than those from petrol and diesel vehicles and further supports the view that NGVs emit less of the pollutants that do most harm.

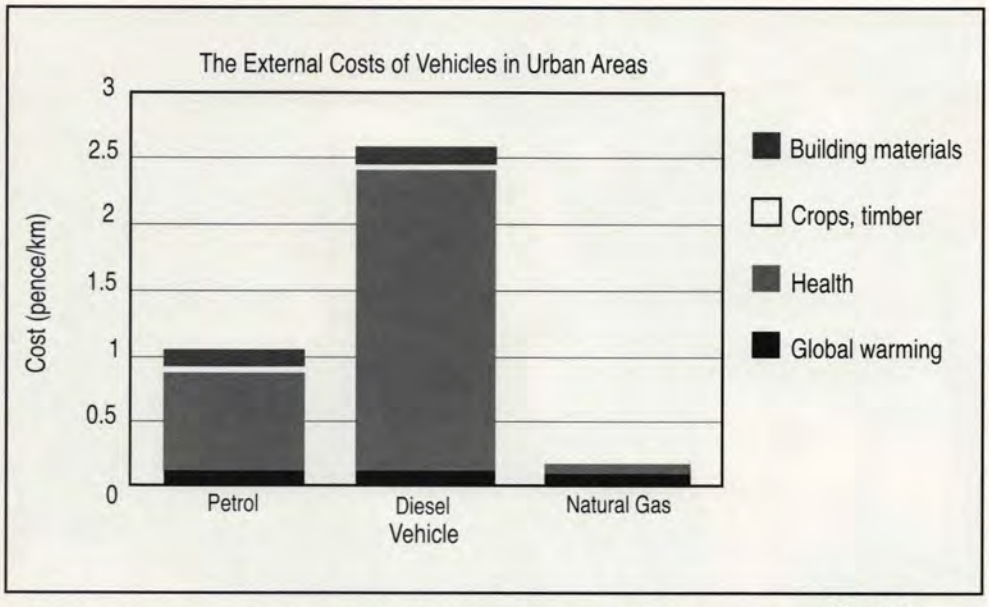


Figure 4

To the extent that these environmental advantages are not properly reflected in fuel prices, transport fuel markets are inefficient and the environment suffers.

This paper was first presented at a seminar 'Greener Fuels for Cleaner Air?, organised by the National Society for Clean Air and Environmental Protection.

BP and the chocolate factory

By Carol Reader

Opening a combined heat and power plant at Nestle Rowntree's York factory, the Rt Hon. John Gummer MP, Secretary of State for the Environment, stressed that the new plant would bring three benefits – a cleaner environment, a reduction in costs and more efficient use of energy.

He said, 'This is an impressive example of the contribution that combined heat and power plants make to energy efficiency and the environment. They need about a third less fuel than conventional methods of generating electricity and steam separately and so provide the opportunity to make a wise use of resources. CHP is a commendable concept and the York scheme makes sound business and environmental sense.'

The new 9.6 MWe gas turbine CHP plant is now generating most of the electricity and all the steam required at Nestle's largest factory which manufactures many of its confectionery lines including Kit Kat, Aero, Smarties, Black Magic, Dairy Box and Matchmakers. A company spokesman told visiting journalists that their largest brand, Kit Kat, is worth £215 million annually and that they are eaten at the amazing rate of 47 every second.

Until now the 140-acre site has been supplied by five coal-fired boilers, built at the turn of the century but now beginning to show their age. Power generated on site was supplemented by electricity bought from the grid. However, what forced a decision to outsource power supply and build a totally new gas-fired CHP plant were the terms of the Environmental Protection Act which stipulated that costly flue gas desulphurisation facilities would be required on the exhaust stacks of the old boiler plant in order to meet emission limits.

Having looked at all the options available from energy management and electricity companies, Nestle awarded the contract to BP Energy which already operates seven industrial-size CHP plants in the United Kingdom. Having designed and built the plant, BP Energy is now operating it under a 10-year outsourcing contract.

The new £8 million plant will bring 'spectacular' savings, in the region of 30 percent or the equivalent of the energy needs of a town of 5,000 houses. Greater energy efficiency is a contributory factor - the CHP plant operates at 85 percent efficiency, compared with only 35 percent for conventional power stations.

The reduction in emissions are substantial – carbon dioxide emissions are estimated to drop by a third and sulphur dioxide to a quarter of previous levels.

The two new gas turbines have a capacity of 9.6 MWe, while two linked heat recovery boilers supply 22 tonnes/hour of steam. Alongside is a water treatment plant for dealkalisation and softening to guarantee an input of 'superclean' water. This capacity should cover all the steam requirements of the factory and most of the electricity needs.

A link into the National Grid ensures that electricity can be either imported in case of emergency or exported at times of low demand such as weekends when the factory does not work.

Reliability and continuity of operation are critical, so BP Energy installed a range of back-up facilities including a standby generator to keep the steam plant in operation and gas oil storage in case there should be interruption to the incoming gas supply from British Gas (the turbines and boilers can be fuelled either by gas or gas oil).

In addition BP Energy has developed a special computer control system, called a plant optimiser, which continuously monitors operations to ensure that the plant runs at all times in the most cost-effective way. BP's challenge is to match the optimum performance indicated by the computer model: Nestle's is to produce yet more Kit Kats.

'Smart' new level transmitter

Level and flow specialists Magnetrol have introduced a new 'smart' version of the EZ Modulevel electronic level transmitter using the HART (Highway Addressable Remote Transducer) protocol, claimed to be the first electronic displacer level transmitter to utilise the latest advances in process control.

The system allows simultaneous analogue and digital communication enabling up to four process variables to be handled in a single message, such as level, temperature, pressure and pH and permits future expansion to other Hart networks with the minimum of wiring changes. The EZ transmitter is easy to install, intrinsically safe and explosion proof and is suited to the most hazardous of environments including applications such as high temperature, high pressure, viscous and aggressive media and hydrocarbons.

Remote calibration can be carried out via a compatible terminal which permits quick and simple entering of parameters such as span, zero point and specific gravity

With safety in mind, the design of the transmitter ensures that the electronics can be removed from the sensing unit and be bench calibrated without the need to dismantle the transmitter or even depressurise the vessel.

The transmitter is available in all 24VDC configurations and can be supplied with or without a HART compatible hand-held communicator.

EZ electronic level transmitter

New low pressure sensor chip provides high output

The development of a new micro-chip has enabled IC Sensors to introduce what it claims is the highest performing low pressure sensors available. The chip is used in the latest additions to the company's TO-8 and HIT sensor series, which feature a double-bossed design giving an output of 100mV at 1 psi. Two versions of the sensor have been introduced. A 0-1 psi (0-7 kPa) measurement range is available, as well as a version optimised for 0-10 in H_20 (0-0.3 psi or 0-2.5kPa). The new sensors have many industrial uses such as process monitoring and pneumatic/hydraulic control.

Two measurement ranges allow more flexibility

Actuator can take heat up to 265°C

A new high temperature pneumatic actuator which is designed to withstand temperatures of up to 265°C has been introduced by process control specialists Alpha Controls.

Following extensive trials the company claims this quarter turn, rack and pinion actuator has a high temperature resistance and is designed to pneumatically pilot fire safety systems. Its features and materials of construction make it a reliable device in any application where fire or excessively high temperatures are potential hazards.

The actuator has an aluminium body which is PTFE coated and seals are manufactured from a special viton to guarantee successful operation in high temperatures.

High temperature actuator

Both single and double acting versions are available, with stainless steel springs on the single acting version. The actuator can accept supply pressures up to 10 bar and torques up to 462 Nm are available.

The need to separately mount solenoid valves is eliminated as Namur solenoid valves can be mounted directly onto the actuator. This ensures a neater and more compact method of connecting solenoid valve and actuator, removing unnecessary pipework, therefore saving time and space.

New gas analyser keeps its lid on

Caldos 5 G-Ex d is the latest addition to the extensive range of gas analysers produced by Hartmann & Braun and is designed specifically to satisfy requirements for Zone 1 applications. A major feature of the new thermal conductivity analyser is its ability to contain within its own housing any potential instrument explosion, making it suitable for measuring non-inflammable and inflammable gases and vapours which occasionally form a potentially explosive atmosphere.

As a thermal conductivity instrument it is primarily intended for determination of single gas components quantitively in a binary or quasi-binary gas mixture. Gases for which the instrument is suitable include hydrogen, nitrogen, hydrogen sulphide, methane and carbon dioxide.

Maintenance revolution

A new process for cleaning fouled but neglected ductwork in marine and offshore installations has been announced by environmental services company System Hygienics.

The company claims it could revolutionise the way in which vital air conditioning ductwork on vessels and offshore platforms is kept clean. Jetvent, developed in Sweden, is ideal for cleaning the small-bore and often inaccessible ductwork typically used in marine ventilation systems.

As a spark-free cleaning method it can overcome the potential hazard of static electricity build-up which occurs when traditional brush-cleaning methods are used.

It is also quicker and more efficient than traditional cleaning methods with less disruption during maintenance.

New standards in suit design and engineering

A major breakthrough is claimed by Plysu Protection Systems with the introduction of its new range of heavy duty chemical incident suits. Designed and engineered by the company's own design team, these new splash suits are said to set new quality standards.

The company claims the new range makes Plysu Protection Systems a serious contender in the fire and rescue services, high risk chemical and petrochemical sectors for the first time.

Plychem is manufactured from advanced rubber-based materials like Hypalon, Neoprene and other chemical-resistant products. The suits are available in two designs and come with all the key protection and comfort features associated with the company's RPE range.

Heavy-duty chemical incident suits

Available in a range of sizes, they offer many other features including a sewn and sealed technology providing optimal chemical resistance on the seams. The suits also have an offset zip design with triple seal to minimise the possibility of chemical ingress as well as incorporating a gas tight rigid cuff and glove system for the arms and a choice of integral or removable boots or elasticated leg ends.

Efficient bitumen production down to new controllers

Yokogawa YS170 programmable controllers installed at Eastham refinery have enabled the production of bitumen to be far more efficient.

Replacing a pneumatic control system, it provides accurate control of temperature and fuel and air input into three large furnaces at the plant, which produces 700,000 tons of bitumen per year. The correct balance of fuel and air is vital to maintain the temperature required to produce the highest quality bitumen. This process, combined with 'Auto Oxygen Trimming', has increased efficiency and reduced fuel consumption.

The old control system operated using pneumatic controllers and copper piping up to 200 yards long - a process prone to leakage and not easily readjusted with combustion stoichiometry.

Whilst the YSl70s are connected to a Yokogawa μXL Central Distributed Control System, they actually operate as stand-alone controllers.

Safety is a key consideration at any oil processing plant and the YS170s on site provide an interlock system to prevent the furnaces firing rich and trip to 'low fire' in the event of system or process alarms.

The versatile controllers are fully programmable, using function blocks and a simple programming language to handle both analogue control computations and sequence logic. Their easy-to-read multi-panel, high resolution, graphic LCD display and one-touch operator interface makes parameter changes far simpler than on an analogue controller, whilst providing a visually compatible display. It also offers a variable time trending display, useful for a quick reference of furnace operation.

Accurate record of temperatures on hand for bitumen production

North Sea mail list – on disk!

Douglas-Westwood Ltd, an oil industry business publications company, now offers a disk with data on over 3,700 North Sea industry organisations and 6,100 key personnel for loading onto your own database. In addition to names and addresses for mail shots, the data includes telephone numbers, country codes and fax numbers. Each record is fully accessible, so you can modify it by using your own database software, adding or deleting records, or data fields. The North Sea List makes an ideal starting point for building an in-house database.

A feature of the disk is that each record has two data fields showing the company's main product or service from a listing of nearly 700. This allows a user to search for all companies with a specific activity such as 'Exploration & Production - UIC', or for example 'Training - Offshore'.

It is available in most popular database formats.

Pneumatic timer for chemical injection pumps

Haskel Energy Systems Ltd have developed a comprehensive range of chemical injection and metering pumps which are driven by compressed air, natural gas or even sour gas. Pressures to 10,000 psi (690bar) and injection rates of between 0.5 - 250 litres per day can be accommodated within the range. The piston stroke length is fully adjustable between 25 percent and 100 percent and cycling speed is controlled by the integral pneumatic timer to between 0-50 CPM.

The all stainless steel construction includes distance pieces to avoid contamination between liquids and gas drive sections. Seal materials are compatible with a wide range of liquids. Built to ISO 9001 quality assurance, the pumps also meet NACE MR-01-75 standards.

Safeguard against data loss with UPS

ICL Edacom has launched two new uninterruptible power supply (UPS) units to help customers to guard against the loss of valuable computer data.

Designed to form a connection between the mains electricity supply and the computer equipment, the new UPS units provide an ongoing, computer-grade power source in the event of a power failure, allowing ample time to back up data. In addition, the unit 'smooths out' fluctuations in the mains supply, protecting against data corruption from power surges and other variations.

The models available both feature a digital display which tells the user how much back-up time is available in the event of a power failure; also displayed is the percentage of the UPS's capacity being utilised.

Uninterruptible power supplies

Assessor aids H&S assessments

Intuitive Solutions Ltd has announced Assessor, a health and safety risk assessment Windows package which can reduce a wide range of costs, from insurance premiums to production losses caused by accidents - the biggest extra cost in the workplace. Its generic approach allows it to be used in any application, and the method of displaying data on a grid system (charting severity against likelihood using hazard symbols) means it is easy to use.

It will be an invaluable tool throughout the public and private sectors, from local authorities to manufacturing, electricity supply to waste disposal and transport.

The package can reduce accidents and demonstrate to the Health and Safety Executive that assessments have been carried out. Any company or organisation with more than five employees must do this; failure to carry out these assessments can result in fines and even temporary closure.

Assessor replaces inefficient paper-based systems that are difficult to operate, prone to human error and which, over time, become unmanageable.

High pressure trouble-free filtration

The new hydraulic filter range uses Parker Filtration's Microglass II multi-layered filter media. This new media combines high filtration efficiencies ($ß_x$ = 200+) with exceptional dirt holding capacities. Designated as Q media, it can be specified as two, five, 10 or 20 microns absolute, ensuring the most cost effective protection for a wide range of hydraulic systems.

Trouble-free filtration is ensured by the new range incorporating such features as an element condition indicator, with the lowest hysteresis available to date, and the proven shock resistant spool-type bypass valve.

Each filter model is available in two bowl lengths, each with threaded ports or a flange face option and a choice of visual or visual/electrical indicator. The filters feature a rugged iron head/steel bowl construction housing which is tested extensively for fatigue and is suitable for applications up to 414 bar.

High pressure hydraulic filters

Truckstop club card

A new diesel fuel card has been launched for use at independent truckstops throughout the United Kingdom.

Aimed specifically at truckstop operators, the Flare Club Card will enable them to offer an electronic local account card system to their customers, in particular small haulage and transport companies and businesses' own HGV and van fleets.

It has been launched by Flare (1980) Ltd, an organisation of seven leading independent oil and fuel supply and distribution companies which provides a 'business forum' to develop new market opportunities.

The system is being successfully operated at many of the Flare members' own sites and is now being marketed on a much wider scale.

Water filtration gets the treatment

The ability to produce clean water is vital in the oil and gas production industry. A new water filtration system which will deliver high volume processing in an economical, low maintenance and compact package has been designed by process systems specialists, Vanpipe, for the new Point of Ayr gas terminal.

The unit will filter the terminal's cooling water, removing contaminants above five micron at a rate of 181.5 M^3 per hour and is 98 percent efficient. The system comprises the main filter vessel together with its associated pipework upon a platform complete with rails, ladder and safety cage.

At the heart of the package is an advanced tubular backwash type filtration system, which uses a five micron polyester filter media and is designed to deliver a high flow rate per unit area. Using a measured pressure build-up and release created by automated valve control during the backwash cycle, it produces a powerful force to swiftly and completely remove cake solids and waste liquid.

Other special features include a control centre which permits the automatic start-up, shutdown and backwash sequences to be actioned through a single, one button function.

CONTACTS

Magnetrol International	01444 871313
IC Sensors	+1 408 432 18 00
Hartmann & Braun Ltd	01604 646311
System Hygienics	01323 520099
Alpha Controls plc	01753 655000
Plysu Protection Systems Ltd	01909 582311
Douglas Westwood Ltd	01227 831879
Yokogawa UK Ltd	01928 579879
Haskel Energy Systems Ltd	0191 549 1212
ICL Edacom Ltd	01279 647000
Intuitive Solutions Ltd	01252 734730
Flare (1980) Ltd	01502 742173
Parker Filtration	0113 253 7921
Vanpipe Ltd	01782 575611

FORTHCOMING EVENTS

May

1st-4th
Houston: '27th Offshore Technology Conference'. Details: OTC Meetings Department, PO Box 833868, Richardson, Texas 75083-3868 USA.
Tel: 214 952-9494
Fax: 214 952-9435

1st-5th
Calgary: 'Improved Oil Recovery – Unit 1: Conventional Injection Methods'. Details: OGCI Training, PO Box 35448, Tulsa, Oklahoma, 74153-0448 USA.
Tel: 1 918 742 7057
Fax: 1 918 742 2272

3rd
Bromley: 'Legislation for Hazardous Area Equipment'. Details: Sira Training, South Hill, Chislehurst, Kent BR7 5EH.
Tel: 0181 467 2636
Fax: 0181 295 3005

4th
London: 'Gas Turbine Power Generation: Commercial, Economic and Operational Challenges'. Details: IChemE Conferences and Courses, 165-189 Railway Terrace, Rugby CV21 3HQ.
Tel: 01788 578214
Fax: 01788 577182

8th-10th
New Orleans: '1995 International Conference on Microbially Inflenced Corrosion'. Details: Patricia Irving
Tel: (1) 800-443-9353

8th-12th
Calgary: Improved Oil Recovery Unit II: Specialised Methods'. Details: OGCI Training, PO Box 35448, Tulsa, Oklahoma, 74153-0448 USA.
Tel: 1 918 742 7057
Fax: 1 918 742 2272

15th-16th
Hong Kong: 'GasTrade '95'. Details: Ms Nicola Chaplin, GasTrade Secretariat, PO Box 670, Chesham, Bucks HP5 2YA.
Tel: 01494 758121
Fax: 01494 758802

15th-16th
London: 'Creating Value Through Improved Strategic Decision Making in Upstream Oil and Gas'. Details: IBC Technical Services Ltd, Gilmoora House, 57-61 Mortimer Street, London W1N 8JX.
Tel: 0171 637 4383
Fax: 0171 631 3214

16th-17th
Derby: 'Permit to Work'. Details: Link Associates, Aspen Drive, Raynesway, Derby, DE21 7SG.
Tel: 01332 677066
Fax: 01332 679609

16th
London: 'The Petroleum Forecourt in a Competitve Retail Market'. Details: Caroline Little, The Institute of Petroleum.

17th-18th
Bordeaux: 'Multimodal Transport: Issues and Developing Factors'. Details: M. Erik Loot, Conseil Régional d'Aquitaine, Hôtel de Region, 14 rue F de Sourdis, 33077 Bordeaux Cedex.
Tel: 33 56 90 53 90
Fax: 33 56 24 73 66

17th-18th
Chester: 'Contaminated Soil Analysis'. Details: David Ruddock/Andrea Belcher, Geochem Group Ltd, Chester Street, Chester CH4 8RD.
Tel: 01244 671121
Fax: 01244 683306

17th-19th
Singapore: 'The China Petroleum Trade Conference'. Details: IBC (Asia Pacific) Conferences, 268 Orchard Road #18-02, Singapore 0923.
Tel: (65) 732 1970
Fax: (65) 733 5087

22nd-23rd
London: 'North Sea Conference 1995'. Details: Conference Registrar, The Conference Division, Lloyd's of London Press Ltd, 1 Singer Street, London EC2A 4LQ.
Tel: 0171 250 1500
Fax: 0171 253 9907

22nd-23rd
Aberdeen: 'Meeting the Challenge of the Information Explosion in the Offshore Industry – What is Required – How to Meet Requirements'. Details: Nadia Ross, IBC Technical Services Ltd, Gilmoora House, 57-61 Mortimer Street, London W1N 8JX.
Tel: 0171 637 4383
Fax: 0171 631 3214

22nd-26th
Bedford: 'The Complete Pumping System'. Details: The Short Course Administrator, Department of Fluid Engineering & Instrumentation, School of Mechanical Engineering, Cranfield University, Cranfield, Bedford MK43 0AL.
Tel: 01234 754766
Fax: 01234 750728

23rd
London: 'Microbial Quality Tests for Fuel Workshop'. Details: Caroline Little, The Institute of Petroleum.

23rd-24th
London: '2nd International Conference on Tanker Demurrage'. Details: Judith McKay/Roger Sepkes, Asdem Ltd, Colette House, 52-55 Piccadilly, London W1V 9AA.
Tel: 0171 493 0973
Fax: 0171 499 5270

23rd-25th
Italy: 'Corrosion in Natural and Industrial Environments'. Details: Nace International,
Tel:(39) 39 748983
Fax: (39) 39 736433

23rd-26th
Azerbaijan: '2nd International Caspian Oil and Gas Conference'. Details: Spearhead Exhibitions Ltd, Ocean House, 50 Kingston Road, New Malden, Surrey KT3 3LZ.
Tel: 0181 949 9222
Fax: 0181 949 8186/8193

24th-25th
London: 'Management and Operation of Ships: Practical Techniques for Today and Tomorrow'. Details: The IMarE Conference Department, 76 Mark Lane, London EC3R 7JN.
Tel: 0171 481 8493
Fax: 0171 488 1854

24th-26th
London: 'Seismic Sequence Stratigraphy; Its Role in Petroleum Exploration and Development Part 1'. Details: The Administrative Secretary, JAPEC, c/o The Geological Society, Burlington House, Piccadilly, London W1V 0JU.
Tel: 0171 434 9944
Fax: 0171 439 8975

25th-26th
London: '1995 Refining Technology Conference'. Details: Ms Fatma Yusuf-Pitt, UOP Ltd, 'Liongate', Ladymead, Guildford, Surrey GU1 1AT.
Tel: 01483 304 863
Fax: 01483 466 298

30th-1st
London: 'Seismic Sequence Stratigraphy; Its Role in Petroleum Exploration and Development Part 2'. Details: The Administrative Secretary, JAPEC, c/o The Geological Society, Burlington House, Piccadilly, London W1V 0JU.
Tel: 0171 434 9944
Fax: 0171 439 8975

FORTHCOMING EVENTS

29th-2nd
Singapore: 'International Shipping and Insurance Law'. Details: Overseas Dept., The College of Petroleum and Energy Studies, Sun Alliance House, New Inn Hall Street, Oxford OX1 2QD.
Tel: 01865 250521
Fax: 01865 791474

June

1st
London: 'Marine Refrigeration'. Details: IMarE Conferences Department, The Institute of Marine Engineers, 76 Mark Lane, London EC3R 7JN.
Tel: 0171 481 8493
Fax: 0171 488 1854

5th-6th
London: 'Oil Project Finance'. Details: IBC Financial Focus Ltd, 57-61 Mortimer Street, London W1N 8JX.
Tel: 0171 637 4383
Fax: 0171 323 4298

6th-8th
Birmingham: 'Eurochem 1995'. Details: Sharon Clark/Frances Knox, Jane Howard PR.
Tel: 0171 622 5549

8th
London: 'Advances in Subsea Electrics and Electronics'. Details: Knighton Enterprises Ltd, 2 Marlborough St, Faringdon, Oxon SN7 7JP.
Tel: 01367 242525
Fax: 01367 241125

11th-16th
The Hague: '5th International Offshore and Polar Engineering Conference'. Details: ISOPE, PO Box 1107, Golden, Colorado 80402-1107. USA.
Fax: (1) 303 420 3760

12th-13th
Newcastle upon Tyne: 'The Gas Industry – Global Growth'. Details: The Institution of Gas Engineers, 21 Portland Place, London W1N 3AF.
Tel: 0171 636 6603
Fax: 0171 636 6602

IP THE INSTITUTE OF PETROLEUM

Call for Papers

Facilities Abandonment

A second conference on Facilities Abandonment will be held on Thursday 16 February 1996 as part of IP Week. This will be a follow-up to the successful conference on the same subject which was organised by the Institute of Petroleum in February this year.

Titles and an abstract (300 words) should be sent to Sjoerd Schuyleman, Technical Manager Upstream, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR by 31 September 1995.

12th
London: 'Measurement of Water in Oil Workshop'. Details: Caroline Little, The Institute of Petroleum.

13th-14th
London: 'Oil Markets: Any Chance of a Price Recovery? When?'. Details: DRI Europe, Wimbledon Bridge House, 1 Hartfield Road, Wimbledon, London SW19 3RU.
Tel: 0181 543 1234
Fax: 0181 545 6248

13th-14th
London: '1st International Conference on the Exploration and Production of Oil and Gas in the Former Soviet Union'. Details: Philippa Giles, Adam Smith Institute, 11-13 Charterhouse Buildings, London EC1M 7AN.
Tel: 0171 490 3774
Fax: 0171 490 2362

14th-15th
London: 'Petroleum Trading and International Law'. Details: Abacus International, 214 Inchbonnie Road, South Woodham Ferrars, Essex CM3 5WU.
Tel: 01245 328340
Fax: 01245 323429

14th-15th
Aberdeen: 'Preventing Oil Discharge from Drilling Operations – The Options'. Details: Nadia Ross/Helen Smith, IBC Technical Services Ltd, Gilmoora House, 57-61 Mortimer Street, London W1N 8JX.
Tel: 0171 453 2130/2128
Fax: 0171 631 3214

15th
London: 'Air Quality Standards – Compliance Workshop'. Details: Caroline Little, The Institute of Petroleum.

19th-21st
Darwin: 'South East Asia Australia Oil Conference 1995'. Details: Ms Megan Small, Darwin
Tel: (61-89) 895263
Fax: (61-89) 895289

19th-20th
Pembroke: 'Terminal Operation and Static Measurement', Details: Abacus International, 214 Inchbonnie Road, South Woodham Ferrars, Essex CM3 5WU.
Tel: 01245 328340
Fax: 01245 323429

20th
Aberdeen: 'Offshore Noise and Vibration'. Details: IMarE Conferences Department, The Institute of Marine Engineers, 76 Mark Lane, London EC3R 7JN.
Tel: 0171 481 8493
Fax: 0171 488 1854

21st-23rd
London: 'Introduction to Oil Industry Operations Course'. Details: Caroline Little, The Institute of Petroleum.

26th-28th
London: 'Introduction to Petroleum Economics Course'. Details: Caroline Little, The Institute of Petroleum.

27th-28th
London: 'Best Practices for Improved Oil Recovery'. Details: Nadia Ross, IBC Technical Services Ltd, Gilmoora House, 57-61 Mortimer Street, London W1N 8JX.
Tel: 0171 637 4383
Fax: 0171 631 3214

27th-28th
Budapest: '1995 Central/East European Gas Conference'. Details: Overview Conferences, 82 Rivington Street, London EC2A 3AY
Tel: 0171 613 0087
Fax: 0171 613 0094

29th-30th
Cannes: '1995 European Oil Refining Conference and Exhibition'. Details: Edward Bradfield, WEFA Ltd, Mappin House, 4 Winsley Street, London W1N 7AR.
Tel: 0171 631 0757
Fax: 0171 631 0754

INSTITUTE NEWS

NEW MEMBERS

Mr A K Agrawal, c/o Y.C. Morakhia, C-05-12 Palmcourt, Brickfields, Kuala Lumpur, Malaysia.
Mr B J Bashford, 14 Outwood Farm Close, Billericay, Essex, CM11 2ND.
Mr S J Bennett, Thomas Sands, Britannia House, 16 High Street, Burnham, Bucks, SL1 7JH.
Mr J Bybordi, Midcent Ltd, 28 Margaret Street, London, W1N 7LB.
Mr R D Capocci, 61 Burnbridge, Seaton Burn, Newcastle Upon Tyne NE13 6DZ.
Miss M Chammas, PO Box 110-732, Beirut, Lebanon.
Mr W Clare, Shell UK Downstream Oil, Shell Mex House, Strand, London, WC2R ODX.
Mr T D P Cole, Rose Cottage, High Street, Cley-next-the-Sea, Holt, Norfolk.
Mr A Del Maestro, 10 Maple Street, London WIP 5GA.
Mr B J Eastham, Goosewest Cottage, Kirkby, Fleetham, Northallerton, North Yorkshire DL7 0SW.
Mr C. Edward, Amec Process & Energy, 106 Tottenham Court Road, London W1A 1BT.
Miss D Emons, 18 Haig Road, Stanmore, Middx, HA7 4EP.
Mr P G Faulkner, Chorley Eng Ltd, Denmore Road, Bridge of Don, Aberdeen, AB23 8JW.
Mr G M Gray, Salomon Brothers International, Victoria Plaza, 111 Buckingham Palace Road, London, SWIW OSB.
Mr M D Green, P O Box 2848, Larnaca, 6503, Cyprus.
Mr R W C Groeneweg, Verpaalen Labs BV, Butaanweg 2g - 31, 3196 KC, Rotterdam, Netherlands.
Mr P F Hawker, RAF Saxa Vord, Unst, Shetland, ZE2 9TJ.
Mr G Inch, A C Nielsen Co Ltd, Nielsen House, Headington, Oxford OX3 9RX.
Mr A S Keeler, Turnpike House, Turnpike Close, Hythe, Kent, CT21 4DE.
Mr R J Lane, Amec Process & Energy, 106 Tottenham Court Road, London W1A 1BT.
Mr R Law, 1 Chadwell Springs, Waltham, Grimsby, South Humberside, DN37 0UU.
Mr J R Macadie, Oakdale House, 20 Iona Drive, Humberston, South Humberside, DN36 4XU.
Mr T McGuire, Dale Carnegie, Suite 33, Stirling Business Centre, Wellgreen Place, Stirling FK8 2DZ.
Dr B I Mohamed, 2 Harts Lane, Barking, Essex IG11 8LZ.
Mr J Moulton, Shell UK Ltd., Shell-Mex House, Strand, London WC2R 0DX.
Mr D L Murphy, New Hextalls West, Hextalls Lane, Bletchingley, Surrey, RH1 4QT.
Mr E A Okoro, Flat 13, Block 2, S Close, 7th Avenue, PO Box 1566 Festac Town, Lagos, Nigeria.
Mr O W Oladiji, 10 Olusesan-Adetula Street, P O Box 5128, Surulere, Lagos, Nigeria.
Mr T Peyton, 21 Ardbeg Road, London SE24 9JL.
Prof D A Pinder, Ramalhaus, Train Road, Wembury, Devon, PL9 OEW.
Mr J B Pope, Frank Ayles & Ass Ltd, 15 New Row, London WC2N 4LA.
Mr J Ragnar, Julver H F, Holmaslod 8, P O Box 1164, 121 Reykjavik, Iceland.
Mrs E Rayner, Shell UK Ltd, Shell Mex House, Strand, London WC2R 0DX.
Ms N J Reed, Andersen Consulting, 2 Arundel Street, London WC2R 3LT.
Mr B Sakhno, Kurzemes Pr. 108, Room 23, Riga, LV-1069 Latvia.
Mr S Stepanov, JSC, 35 Myasnitskaya Str., Moscow, Russia 129010.
Mr I Swanson, 44B Kheam Hock Road, 1129, Singapore.
Mr A V Swing, 11 Clarence Gate Gardens, Glentworth Street, London, NW1 6AY.
Mr G J Thorne, Morton Int. Ltd, Westward House, 155-157 Staines Road, Hounslow, Middlesex.
Mr P A Williams, Shell UK Oil Downstream, Yarn St, Hursley, Leeds LS10 1QS.
Mr J G Young, Braeside, Benridge Bank, West Rainton, Tyne & Wear, DH4 6NN.

STUDENTS

Mr G J Mace, 29 Kenilworth Road, Kilburn, London, NW6 7HL.
Mr G Osawaye, 33E Talbot Road, Tottenham, London, N15 4DF.
Mr O A Shogbamimu, 184 Fordwych Road, Cricklewood, London, NW2 3NX.

OBITUARY

Dr T F Gaskell F Inst Pet

It is with regret we report the death of Dr TF Gaskell in March.

He won a scholarship to Trinity College, Cambridge where he graduated with First Class Honours in both Part I and II in the Natural Science Tripos. This was followed by a PhD in Geophysics.

He spent most of his working life in the oil industry. After serving with the Admiralty during World War II, he joined the Anglo-Iranian Oil Co in 1946 as chief petroleum physicist, engaged in reservoir engineering, pipeline studies and quality control.

From 1949-52 he was seconded to join *HMS Challenger* oceanographic expedition as chief scientist. This Royal Navy expedition made seismic and deep water measurements in all the oceans of the world.

He subsequently returned to BP and worked in various research and exploration departments, latterly as Scientific Adviser to the Public Affairs and Information Department.

Dr Gaskell was Chairman of the (international) Commission for Marine Geology and an executive member of the Scientific Commission for Oceanic Research. He served on the Council of the Society for Underwater Technology.

One of his several books was *North Sea Oil*. He was well known as a lecturer and appeared on radio and television in many countries.

Dr Gaskell was an active member of the IP, serving on various committees. From 1960-66 and 1969-75 he was a member of Council.

Around the Branches

Southern Branch
9 May: Wine tasting

Aberdeen Branch
9 May: *1993 Technology Award Winners* Sid Littleford of Petroleum Engineering Services

Southern Branch
13 June: Visit to Heathrow Airport. Airside Operations

Benevolent Fund

The Institute of Petroleum has a Benevolent Fund for the provision of financial and other relief or assisance to necessitous persons who are or have been members of the Institute and the necessitous wives, widows, families and dependent relatives of such persons as the Management Trustees in their absolute discretion think fit. If members of the Institute are aware of any such necessitous persons, even if their membership of the Institute has ceased, they are asked to inform the Institute. Applicants would be asked to complete a form giving details of their financial circumstances which would be treated in strict confidence. Help might be given for temporary difficulties, such as the cost of convalescence following illness.

INSTITUTE NEWS

UK Deliveries into Consumption (tonnes)

Products	*†Feb 1994*	**Feb 1995*	*†Jan-Feb 1994*	**Jan-Feb 1995*	*% Change*
Naphtha/LDF	250,135	343,311	550,043	619,090	13
ATF – Kerosene	458,453	491,525	992,161	1,019,072	3
Petrol	1,733,210	1,649,322	3,442,995	3,282,425	-5
of which unleaded	965,850	1,005,710	1,916,439	1,993,729	4
of which Super unleaded	107,072	77,766	211,080	153,099	-27
Premium unleaded	858,778	927,944	1,705,359	1,840,630	8
Burning Oil	361,946	303,368	652,326	607,077	-7
Derv Fuel	969,119	1,046,508	1,885,694	2,006,218	6
Gas/Diesel Oil	725,857	645,905	1,402,918	1,341,601	-4
Fuel Oil	863,843	906,301	1,725,880	1,703,414	-1
Lubricating Oil	61,061	69,320	123,068	137,008	11
Other Products	592,812	649,774	1,173,156	1,321,704	13
Total above	**6,016,436**	**6,105,334**	**11,948,241**	**12,037,609**	**1**
Refinery Consumption	465,771	482,717	1,045,226	1,054,360	1
Total all products	**6,482,207**	**6,588,051**	**12,993,467**	**13,091,969**	**1**

*† Revised with adjustments *preliminary*

New IP Staff

Mr John Evans has been appointed Membership Services DIrector and takes up his appointment on 9 May.

Educated at Wallasey Grammar School and the University of Salford, where he studied Economics and Politics, he joined the then 'Dyestuffs' Division of ICI in 1968. In the next 25 years he had many sales and marketing jobs, which varied from developing a new coloured pigments business in South East Asia to running a central heating business in the United Kingdom and included living in Johannesburg, Singapore, Istanbul and Paris. For the last 10 years he has been involved in the former communist countries of Eastern Europe and the Soviet Union. Since 1993 he has been seconded to the Department of Trade and Industry as an Export Promoter for Poland giving the benefit of his own experience to some 1,500 British companies.

Mr Evans is taking over from Mr Roger Sparrow who is retiring.

PEOPLE

Scottish Enterprise is to strengthen its commitment to oil and gas, power generation and renewable energy with the appointment of *Mr Hamish Dingwall* as head of its Oil and Gas team based in Aberdeen. He will report to *Mr Kourosh Bassiti* who, as Head of Energy, will focus on power generation and renewables, and the development of pan-Scotland public and private sector links.

After its first successful year, the UK Non Operators Forum (NOF) has elected three new Directors. **Stewart W Watson** of DSM Energy (UK) Ltd has been elected to the Board and appointed Chairman, while **Alan Whigget** (Santos) and **George Goodsir** (OMV) are to join the Board alongside **Graham Rawlinson** of Santa Fe. The NOF was set up in January 1993 to promote the interests of and encourage co-operation between its members, comprising oil and gas exploration companies which are active non-operating participants in the United Kingdom Continental Shelf.

Arthur Stephens has been appointed chief executive of Brown & Root, with responsibility for the company's operations in Europe, Africa and the former Soviet Union. He is replacing **Keith Henry** who has moved on to be chief executive of privatised generator National Power.

Gordon Anderson, chairman, president and chief executive officer of Dallas-based oil and gas exploration and production company, Sant Fe International Corporation, has been elected to the board of Oceaneering International, the Houston-based specialist engineers.

Simon Storage Group has recently made two new appointments to strengthen the top team of its Aviation and Plant Services Division based at Redhill in Surrey. **Lee White** joins as General Manager from safety industry company, Siebe Gorman, where he was managing director and **Tony Hudson** joins as Sales Manager.

Cornell Pump (Europe), the Bury St Edmunds based division of Roper Industries Europe Ltd, have appointed **Simon Ruffles** as European Sales Manager. He will be responsible for increasing the presence of Cornell pumps throughout Europe via their established distributor network in addition to all aspects of sales and marketing for the Cornell product range in South Africa and the Middle East.

Walter Ritchie has been appointed president of Western Atlas Software, a division of Western Atlas International. Prior to his appointment, Mr Ritchie served as the general manager of Western Geophysical, also a division of Western Atlas International.

Ovoline Lubricants have announced the appointment of *John Taylor* as their first ever Head of Technology. He has worked in the lubricants industry for 25 years, ultimately with Shell UK Ltd.

The Offshore Petroleum Training Organisation (OPITO), the body responsible for setting training standards in the oil and gas sector, has announced the appointment of a new Chief Executive and Chairman. *Mr John Ramsay* (right), takes over as Chief Executive from *Mr John Batchelor* who resigned last year. Shell Expro's Director of Personnel *Mr Peter Lobban* (left) takes up the position of Chairman following the retiral of *Mr Andrew Armstrong*.

Joe Chatoor has been named senior vice president of Western Geophysical's worldwide data processing operations. Mr Chatoor will co-ordinate and supervise activities throughout Western's seismic data processing and software development network.

Sheldon Erikson and **John Huff** have been elected to Triton's Board of Directors. Both are oil industry executives who have worked for many years in the international business arena. Erikson has been chairman, president and chief executive officer of The Western Company of North America since 1987. Mr Huff has been chairman, president and chief executive officer of Oceaneering International, Inc since 1986.

Easigoe, the Aberdeenshire-based enterprise which conducts computer linked sales of oil and gas equipment, has announced that **Richard Newman** has joined the company. He will concentrate specifically on oil and gas related disposal and valuation.

At its recent AGM, Brindex elected the following Executive Officers to serve during 1995. **Mr John Raitt** is to be Chairman, **Mr Alan Gaynor**, Vice Chairman, **Mr Mark Hope**, Honorary Secretary and **Russel Harvey** is Honorary Treasurer.

Hartmann & Braun increase its sales strength in the north of England with the appointment of **David Inward** to coincide with the launch of a new generation of emission monitoring and gas chromatography equipment. He joined the company in 1992 as a field sales support engineer.

Ugland (UK) has a new managing director following the sudden resignation of **Steve Davey**. Mr Davey joined from Stena Offshore just over a year ago and no reason has been given for his departure. His replacement is **Nils Alvheim**.

Energy industries contractor AOC International has appointed **Bill McGillivray** to its board as business development director. He joins AOC after 17 years with Shell Expro as production manager for the North Sea Brent field.

Aran Energy Exploration has appointed **John Craner** as finance director and **Colin Tannock** as chief geologist. Aran Energy Exploration is a subsidiary of Aran Energy.

Dave Thompson of Ingersoll-Rand has been elected President of the British Compressed Air Society (BCAS). Mr Thompson is the UK general manager of the Production Equipment Group of Ingersoll-Rand Sales Company Ltd.

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THE INSTITUTE
OF PETROLEUM

The Petroleum Forecourt in a Competitive Retail Market

16 May 1995

To be held at the Institute of Petroleum

Presentations will include:

- Keynote address
  J Attwood, Director of Retail Marketing, Total Oil Great Britain Ltd
- Trends in UK Shopping Habits
- The Service Station of the Future
- The Ecological Filling Station of the Future – MOL 2000
- Brand Projection – The Implications and the Opportunities for the Independent Distributor and Retailer
- Retail Development – Planning Constraints
- Rebuilding the Forecourt to Optimise Opportunities – The Modular Approach
- Forecourt Retailing — An Independent Perspective

For a copy of the registration form, please contact Conference Department, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR UK
Telephone: 0171 467 7100 Fax: 0171 255 1472

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THE INSTITUTE
OF PETROLEUM

Measurement of Water in Oil Workshop

12 June 1995

To be held at the Institute of Petroleum

This inter-active workshop will focus on automatic sampling and test procedures for the measurement of water and sediment in stabilised crude oils. Presentations will be made by speakers from equipment manufacturers, inspection companies, oil companies, the National Engineering Laboratory and the DTI Gas and Oil Office. Attendees are encouraged to participate in a debate on the subjects and to voice their problems and experiences.

Presentations will include:

- Sampling – an Inspector's viewpoint
- Assessment and differentiation of IP, API and ISO Sampling Standards
- Applying the Standards in practice
- Sample mixing and handling
- Determination of water and sediment contents
- Determination and use of wet and dry oil densities
- Techniques for low and high water-cut samples
- Evaluation of trials with an on-line water-in-oil measurement system
- The Regulator's view

For a copy of the registration form, please contact Conference Department, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR UK
Telephone: 0171 467 7100 Fax: 0171 255 1472

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THE INSTITUTE OF PETROLEUM

Petroleum Measurement Paper No 7:

'A Guide to Recommended Measurement Practice for Compliance with the Requirements of HM C&E Notice 179.

This Guide has been prepared as recommended good measurement practice for the transfer of dutiable mineral oils out of duty suspension in order to meet the mandatory requirements of HM Custom & Excise Notice 179: *Mineral (Hydrocarbon Oils): Duty and VAT: Warehousing and Related Procedures*. It represents a collaborative effort by the Institute of Petroleum, HM Customs & Excise, the Independent Tank Storage Association, the Solvent Industries Association and the UK Petroleum Industry Association.

The Guide effectively replaces Notice 179M: *Flow Meters at Bonded Oil Installations*, which has been withdrawn. However, its scope has been extended beyond flow measurement to include level and temperature measurement and weighing. For each form of measurement, guidance is provided on its basic principles, recommended operational procedures and HM C&E mandatory requirements (where appropriate), together with IP recommendations for the accuracy, installation, proving, verification etc. of equipment. The Guide will form a reference for HM C&E offices for the assessment of measuring equipment and procedures at duty suspended installations.

ISBN 0-85293-148-4 44pp Published in April 1995
Price: £28.00 (Overseas £30.00)

Model Safe Loading Pass Scheme

The purpose of a safe loading pass scheme is to indicate to participating companies that a particular vehicle meets basic safety standards with regard to risk of spillage and fire, and can be allowed access to the types of road loading gantries specified on the safe loading pass without the need for further inspection.

The Institute of Petroleum publishes this Model Safe Loading Pass Scheme solely to provide a procedure which can be adopted by companies wishing to participate with other companies in a scheme. The Institute will not administer or be responsible for schemes but may provide a forum in its committees for review of the effectiveness of schemes. Nor can it arbitrate in any case of dispute or difference. The decision to set up or participate in such a scheme and to issue vehicles with safe loading passes will be solely the responsibility of the participating companies concerned.

The appendices include documents that can be used in the administration of a safe loading pass scheme.

ISBN 0-85293-153-0 Published in 1995
Price: £16.00 (Overseas £18.00)

Specifications and Qualification Procedures – Aviation Fuel Filter Monitors with Absorbent Type Elements

This publication which has been prepared by the Aviation Committee is designed to provide the industry with comprehensive specifications and qualification test procedures for filter monitors with absorbent type elements suitable for use in aviation jet fuel handling systems. The specifications do not cover trigger type monitor elements.

These specifications are for the convenience of purchasers in ordering, and manufacturers in fabricating filter monitor vessels and elements of the absorbent type; they are not in any way intended to prohibit either the purchase or manufacture of filter monitors meeting other requirements.

Purchasers may wish to install absorbent type filter monitor elements in vessels originally designed for use with other types of elements. In these cases the element specification and performance requirements of this publication may be used for the purchase of elements without a new filter monitor vessel.

This second edition of this specification replaces the first edition published in 1987 which is no longer applicable.

ISBN 0-85293-137-9 Published in 1995
Price: £28.00 (Overseas £30.00)

Discount of 25 percent for IP members buying these publications.

Copies are available from the Library, The Institute of Petroleum, 61 New Cavendish Street, London W1M 8AR.