Oil in troubled waters

Prices are sky-high, with profits to match. But looking further ahead, the industry faces wrenching change, says Vijay Vaitheeswaran

"THE time when we could count on cheap oil and even cheaper natural gas is clearly ending." That was the gloomy forecast delivered in February by Dave O'Reilly, the chairman of Chevron Texaco, to hundreds of oilmen gathered for a conference in Houston. The following month, Venezuela's President Hugo Chavez gleefully echoed the sentiment: "The world should forget about cheap oil."

The surge in oil prices, from $10 a barrel in 1998 to above $50 in early 2005, has prompted talk of a new era of sustained higher prices. But whenever a "new era" in oil is hailed, scepticism is in order. After all, this is essentially a cyclical business in which prices habitually yo-yo. Even so, an unusually loud chorus is now joining Messrs O'Reilly and Chavez, pointing to intriguing evidence of a new "price floor" of $30 or perhaps even $40. Confusingly, though, there are also signs that high oil prices may be caused by a speculative bubble that could burst quite suddenly. To see which camp is right, two questions need answering: why did the oil price soar? And what could keep it high?

To make matters more complicated, there is in fact no such thing as a single "oil price": rather, there are dozens of varieties of crude trading at different prices. When newspapers write about oil prices, they usually mean one of two reference crudes: Brent from the North Sea, or West Texas Intermediate (WTI). But when ministers from the Organisation of the Petroleum Exporting Countries (OPEC) discuss prices, they usually refer to a basket of heavier cartel crudes, which trade at a discount to WTI and Brent. All oil prices mentioned in this survey are per barrel of WTI.

The recent volatility in prices is only one of several challenges facing the oil industry. Although at first sight Big Oil seems to be in rude health, posting record profits, this survey will argue that the western oil majors will have their work cut out to cope with the rise of resource nationalism, which threatens to choke off access to new oil reserves. This is essential to replace their existing reserves, which are rapidly declining. They will also have to respond to efforts by governments to deal with oil's serious environmental and geopolitical side-effects. Together, these challenges could yet wipe out the oil majors.

The ghost of Jakarta

But back to the question of why prices shot up in the first place. The short explanation is that oil markets have seen an unprecedented combination of tight supply, surging demand and financial speculation. One supply-side factor is OPEC's clever »

Many people generously helped with this survey. Particular thanks go to Edward Morse, Fatih Birol, Daniel Yergin and David Victor. A full reading list is at
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manipulation of output quotas. Back in 1997, at a ministerial meeting in Jakarta, the cartel decided to raise output just as the South-East Asian economies were hit by crisis, sending prices plunging to $10. Desperate to engineer a price rebound, Saudi Arabia targeted inventory levels: whenever oil stocks in the rich countries of the OECD started rising, OPEC would reduce oil quotas to stop prices softening. It worked like a charm.

Another supply-related factor has been the shortage of petrol in the American market. Over the past year or two, prices have spiked as refineries have been unable to meet local demand surges.

Supply concerns have also played a part in the so-called fear premium. The nerve-wracking uncertainty before the invasion of Iraq, and the terrible terrorist attacks in Iraq and Saudi Arabia afterwards, have pushed up prices to a higher level than the fundamentals would seem to justify. Other supply worries arose from the crackdown by the Russian president, Vladimir Putin, on the oil company Yukos, and from civil strife in Venezuela and Nigeria. Some pundits think the fear premium may have added $7 to $15 to the cost of oil on futures markets in New York and London.

Adding to the froth has been the sudden influx of new kinds of financial investors into the oil market. Some are merely chasing the huge returns recently offered by oil. Big equity funds, fearful of what $100 oil could do to their holdings, might invest in oil futures at $40 or $50 as a cheap insurance policy. OPEC ministers love to blame hedge funds for high oil prices, but they are only partly correct. The "net long" positions (that is, their speculative bets on higher prices) held by such funds peaked in March last year and dropped through 2004, but oil prices kept rising regardless.

Phil Verleger, an energy economist associated with the Institute for International Economics in Washington, DC, reckons that the cartel itself may be to blame for the speculation: by declaring its intention to prop up prices, first at $30 and now at $40, "OPEC has given Wall Street a free put option" (because investors believe the cartel will cut output to stop prices falling).

Supply constraints coincided with a huge boom in oil demand. Global oil consumption last year increased by 3.4% instead of the usual 1-2%. Nearly a third of that growth came from China, where oil consumption rocketed by perhaps 16%. One senior European oil executive claims that, in contrast with the embargoes and supply-driven price rises of the past, "This is the first demand-led oil shock."

And it was not just China that used a lot more oil. India's oil consumption too leapt last year, and America's was quite robust. In fact, despite $50 oil, global oil demand in 2004 grew at the fastest rate in over 25 years. The global economy also grew at a

Not so shocking

Does the oil price matter any more?

HOW is it that oil prices have been able to shoot from $10 a barrel to over $50 without triggering an economic shock? The conventional reckoning is that every $10 hike in the oil price will knock half a point off global GDP growth—and yet the rise to $50 seemed to make little difference to the global economy last year. Oil is priced in dollars, so the steep dollar depreciation in recent months should have helped the European Union. Yet despite that boost, the euro-zone countries grew by only 2% last year, whereas America, which was fully exposed to the oil-price hike, grew at 4.4%. China, with growth of around 10%, was in a class of its own.

Ken Rogoff, a professor at Harvard and former chief economist of the IMF, argues that the "world really did not have a clear picture" of the relationship between oil and GDP. He now thinks that a gradual rise to an oil price of $80 "would not present any great difficulties for the global economy". If it happened over five or ten years, consumers would adjust by becoming more energy-efficient, using new technologies and perhaps even re-thinking their transport arrangements.

The recent price rise coincided with low global inflation and strong demand-led growth, which meant it was easily absorbed. In contrast, the 1970s oil-price hike came at a time of high inflation, wage and price indexation and economic malaise. Mr Rogoff argues that the world's central banks have also become much more credible inflation-fighters, so oil-price rises have not been feeding through to higher interest rates.

Another important factor is that the OECD countries have become much less energy-intensive, thanks to the shift from manufacturing to services. America, for example, uses only half as much oil per unit of GDP as it did 30 years ago. In value terms, oil's share of OECD commodity imports plunged from 13% in the late 1970s to 4% in the late 1990s.

When the pips start to squeak

So does that mean the oil price does not matter any more? Not quite. Some economists now argue that this relationship is asymmetrical. A rise from $10 to $20, or $40 to $50, may not cause much harm, but further rises, even if they are quite modest in percentage terms, may become increasingly damaging, especially if they happen quickly.

In fact, argues Fatih Birol, chief economist of the International Energy Agency, present price levels may already be dampening the current cyclical upturn. In particular, they may be hurting the world's developing countries. Many poor countries are more dependent on imported oil and use energy far less efficiently than do rich countries as they make a dash for manufacturing-led growth. Economists are still trying to make sense of the "non-shock" of 2004, but some lessons are already clear. First, the world's utter reliance on petroleum for transport still leaves it highly vulnerable to an oil shock at some price. That, argues Mr Rogoff, is reason enough for America, the world's biggest oil consumer, to impose a carbon tax: "Either we raise the price of oil, or OPEC will."

Second, comparing prices in absolute terms can be misleading, because over a period of time inflation can make a big difference. In today's money, the oil price actually topped $80 a barrel during earlier oil shocks. So in the end the oil price is still important: it's just that $50 ain't what it used to be.

scorching pace. That appeared to defy the conventional wisdom that high oil prices drag down demand, and prompted the question whether oil prices even matter any more (see box, previous page).

No safety net

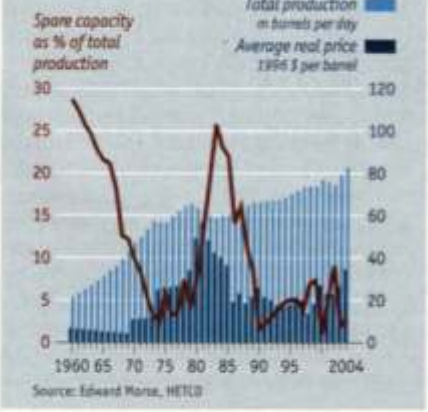
So was it supply or demand that pushed prices above $50? Both matter, of course, but neither provides a complete explanation. What is new, and what has set the market alight, is the lack of spare production capacity.

In a normal commodity market, no producer in his right mind would keep lots of idle capacity. But that is precisely what several OPEC countries have been doing with their oil wells for years. Saudi Arabia, in particular, has maintained a generous buffer that it has used to prevent the market from overheating during unexpected supply interruptions. For example, during the Iran-Iraq war, the first and second Gulf wars and Venezuela's political crisis of 2003, oil exports from the countries concerned were disrupted, but the Saudis immediately started pumping more oil from their idle fields and single-handedly prevented a price surge and possibly an oil shock. This vital buffer, argues Robin West of PFC Energy, a consultancy, helps Saudi Arabia to act as the "central bank of oil".

Alas, the buffer has been in decline for some years, because OPEC has not been investing sufficiently to keep pace with growing demand. As a result, global spare capacity last year dropped to around 1m barrels per day (bpd), close to a 20-year low. Almost all of this was in Saudi Arabia. In short, the market for the world's most essential commodity now has no safety net to speak of.

At full stretch 1

World oil production, spare capacity and prices



Source: Edward Morse, HETCO

In such a tight market, argues Edward Morse of HETCO, an energy-trading company, even relatively minor changes in supply and demand can get magnified into unnerving price spikes. In the past, there has often been an inverse relationship between spare capacity and oil prices (see chart 1). The IMF has recently told OPEC that it must increase global spare capacity to 3m-5m bpd in order to ensure "the stability of the world economy."

More worryingly, Mr Morse believes the problem extends well beyond just spare production capacity. He points to the tightness in markets for oil rigs, tankers, petroleum engineers, refinery capacity and various other bits of the oil value chain, and concludes that the problem is systemic: "The illusion that oil is in perennial oversupply has led to two decades of underinvestment in the oil industry. The world has been living off the legacy spare capacity built up many years ago."

Given today's high prices, surely the market will soon enough provide the necessary new infrastructure? Probably not, for two reasons. The first is that the world seems to be coping rather well with today's shockingly high prices, so perhaps they have to persist for longer or rise higher still before investors are stirred into action. The second reason is the bitter memory of oil at $10 a barrel.

OPEC countries are unlikely to rush to build lots of spare capacity because they are worried that another price collapse may follow. PFC Energy observes that when the oil price hit $55 late last year, spare capacity was less than 15% of the 8.7m bpd peak reached in 1985, and notes: "OPEC national interests do not lie in creating large capacity surpluses that have existed for most of the history of oil."

The western oil majors are even more terrified of another price collapse, and are keeping a tight rein on their capital expenditure. Projects are typically "stress-tested" for profitability at $20 a barrel or below. Some argue that Big Oil is being too cautious. But nobody thinks that spare capacity will ever return to the gold-plated levels of the mid-1980s.

Still, the crunch may ease if the Saudis rebuild their buffer. It may be in their interest to do so. For most of the OPEC countries, it makes sense to try to maximise prices in the short term because their reserves of oil are relatively small. The Saudis, by contrast, are sitting atop at least 260 billion barrels of proven oil reserves, far more than Libya, Venezuela, Indonesia and Nigeria combined. Even at current

Wherever next? 2

Oil price*, $ per barrel

*1904-44: US average; 1945-83: Arabian Light posted at Ras Tanura; 1984-2004: Brent dated

Sources: BP; Thomson Datastream; The Economist

production levels of around 10m bpd, which make them the world's top exporters, they have enough oil to pump for most of this century. They will not want prices to stay too high for too long, or else investors will put money into non-OPEC oil or alternative fuels.

The desert kingdom's rulers also remember the lessons of the 1970s oil shocks, when the biggest losers were not consuming economies (which eventually adapted to higher prices) but the petro-economies of OPEC. Ali Naimi, the Saudi oil minister, rejects the idea that his country wants prices to rise ever higher: "We are misunderstood: we thrive on the economic growth of others, which is concomitant with energy demand." That is why the Saudis have long acted as the voice of moderation within OPEC, resisting calls from price hawks such as Libya, Iran and, since the rise of Mr Chavez, Venezuela to squeeze consumers.

Indeed, at the most recent formal OPEC meeting, held in Iran on March 16th, the Saudis in effect bullied reluctant cartel members into trying to calm prices down. They won agreement for a rise in oil production quotas to boost global oil inventories that looked like a reversal of the cartel's established policy of keeping OECD inventories tight and prices high.

Developments within Saudi Arabia seem to confirm that the buffer is being rebuilt. Saudi Aramco, the state-run oil giant (and the world's largest oil company), has recently launched its biggest expansion programme in many years. Outside contractors report a surge in rig counts and drilling activity as the country increases spare capacity to its stated goal of 1.5m-2m bpd. But even if Saudi Arabia is willing to re-establish an adequate buffer, this could take years. Will prices stay high until then?

For much of the late 1980s and 1990s

the world enjoyed low and stable oil prices between $20 and $30. Now oil prices have shifted to double that level, apparently without causing much pain. OPEC ministers and Wall Street analysts talk of a new "price paradigm". At first sight, there seems to be something in that. In the past, contracts for delivery of crude months or years ahead (what Alan Greenspan, the chairman of the Federal Reserve, has poetically called "distant futures") usually stayed low and stable even if the spot price shot up because of some short-term disruption. But for the past couple of years the distant futures have tended to shoot up too. The markets clearly expect that higher prices are here to stay.

Political scientists point to the bloated welfare states in most OPEC countries which will require higher oil prices to balance budgets and avoid social unrest. Some industry analysts see a new "floor" price of $30-40, if only to persuade oil firms to splash out on necessary investments upstream. Matt Simmons, a prominent energy investment banker, thinks that in view of rising input costs (for such things as oil rigs, steel pipes, tankers and so on) the oil price "needs to go way, way up".

But some of this may be wishful thinking. In reality, oil companies have little control over prices. OPEC ministers are better placed, but even they cannot reliably control the oil market, as the industry's history of booms and busts clearly shows. Saudi Arabia's Mr Naimi seems to be arguing for moderation when he says that working out a fair price for oil is "a moving target: it needs to be comfortable for both consumers and producers, and at a level where investors will put money in to grow this industry." But it is quite possible that prices could drop lower even than Mr Naimi would wish.

One factor is potential weakness in demand. There is much talk about Chinese demand changing all the rules, but that is just plain wrong. China's share of world oil consumption is still under 8%, far smaller than America's at 25%. Goldman Sachs, an investment bank, estimates that even assuming robust growth, China will remain a smaller oil consumer than America for decades to come.

And the growth in China's oil demand of nearly 16% last year is unsustainable. For one thing, there are simply not enough cars in all of China to guzzle that much oil. Much of the 2004 rise was related to the country's overheating economy and is unlikely to be repeated. For example, shortages of cheap coal led to the use of pricey fuel oil or dirty diesel for electricity generation; as bottlenecks in the coal system ease, that oil use will disappear. Over the past two years, as the country has developed its oil infrastructure, it has needed to fill pipelines, storage tanks and the like, but these were one-off purchases. The International Energy Agency (IEA) says that in January and February 2005, Chinese oil demand rose by only 5.4% on the same period in 2004, less than a quarter of the rate a year earlier. And if China's banking sector or its overall economy takes a knock, oil consumption is bound to be hit too.

Follow that oil price

On the supply side, too, things may ease up. Julian West of CERA, an energy consultancy, has compiled a list of all of the oil projects, led by both government companies and by private firms, that are due to come on stream over the next few years, "all found, all commercial, and all economic at half today's price." He calculates that this "river of supply" could lead to a dramatic net increase in global oil production, with 2007 perhaps seeing the largest rise in production capacity in history. By 2010, this might add 13m bpd to the 2004 total of 83m bpd. Not everyone agrees with his assessment, and Mr West himself cautions that geopolitics could choke off this pending supply, but otherwise "the supply problem in two to four years will be too much oil."

The financial markets offer another possible route to a sharp fall in oil prices. Pension funds have usually shunned commodities in the past, but in the past year or two they have poured tens of billions of dollars into securitised investments in oil, hoping for returns above those they can get on the anaemic stockmarkets. Mr Verleger worries that they have now developed a herd mentality reminiscent of the internet boom. As returns inevitably decline over time, the herd may turn tail and prompt a price collapse. In short, despite China's undeniable thirst and the shortage of global spare capacity, the oil-price boom may yet prove a bubble.

Volatile substance

Aramco's boss, Abdallah Jumah, sums it up: "Where the oil price goes, nobody knows." He wishes it were otherwise. "The key is stability so we can plan. Oil investments take a long time to come to fruition." His boss, Mr Naimi, argues that "oil is simply too vital a commodity to be left to the vagaries of the marketplace." But even Saudi Arabia cannot guarantee oil-market stability, especially with its buffer so depleted. Indeed, the only sensible thing anyone can say about oil prices today is that they are unlikely to remain stable. A terrorist attack on Saudi oil infrastructure could send them past $100; a financial-market crash could push them below $10.

That uncertainty creates enormous problems for the western oil majors. Big Oil has never been much loved, but since OPEC's rise in the 1970s the majors have actually been the consumer's best friend because their success at developing non-OPEC oil has restrained the cartel's market power. So it is worrying that their economic health is not as robust as it appears.

Global or national?

The perils facing Big Oil

ONE day in February this year, something extraordinary happened in the oil patch. Buoyed by news that Exxon Mobil had earned a whopping $25 billion in profits last year, punters sent the company's market capitalisation shooting past $400 billion. The stodgy "old economy" company created by the merger of two descendants of Rockefeller's original Standard Oil empire became the most valuable company in the world, topping such icons of the post-modern age as Wal-Mart, Microsoft and GE.

This was but the latest sign that the private oil majors are enjoying a golden age. A little earlier, Royal Dutch/Shell, shrugging off an accounting scandal about the misreporting of oil reserves (see box, next page), had posted the highest annual profits in British corporate history. On both sides of the Atlantic, the majors have so much cash in hand that they are busy shovelling it back to shareholders. Douglas Terreson of Morgan Stanley, an investment bank, who correctly predicted the wave of mergers in the late 1990s that created such "super-majors" as Exxon Mobil and Chevron Texaco, declares that "the industry is the healthiest it has ever been."

Really? The profits are certainly breathtaking; and industry boosters argue that handing back cash to shareholders shows extraordinary capital discipline. Exxon Mobil is running its post-merger empire with about the same number of employees as were needed for Exxon alone a few years ago. The majors now deliver excellent shareholder value, which during most of the 1990s they did not.

But the chief factor behind today's profits is the surge in the oil price. And beyond that mountain of profits, the industry faces challenges that could ultimately wipe out some or most of these firms, once venerated as the Seven Sisters.

The biggest firms may be running out of good ways to invest their money. Oil bosses such as BP's Lord Browne and Exxon's Lee Raymond vigorously deny it, but it seems that the majors, though cash-rich, are opportunity-poor, just when their dwindling reserve base badly needs topping up.

Running to stand still

"Oil is a depleting asset. Every day, if we don't spend money and find more oil, we lose assets. Most oil companies, by doing nothing, will shrink to one-fifth today's size." So says Steven Farris, president of Apache, an independent American oil-exploration firm.

That points to the biggest threat confronting the majors: the rundown of reserves. On IEA estimates, the world will need to spend $3 trillion over the next 25 years in order to meet expected global oil demand. Most of that money will go not to increase global supply, but merely to replace output from today's ageing fields (see chart 3).

Much of the majors' production today comes from large fields in places such as Alaska, the Gulf of Mexico and the North Sea, representing the first great wave of non-OPEC exploration. These fields saved the western oil companies after the nationalisations of the 1970s and helped to check OPEC's market power. But now they are entering a phase of rapid decline. Companies are spending ever greater amounts on fancy technologies and enhanced oil-recovery techniques. Field-maintenance costs are soaring.

The troubles in North America and the north Atlantic have sent the majors scrambling to explore far riskier oil prospects in non-OECD countries. Western firms are now looking for growth in such places as West Africa, the Caspian and the ultra-deep waters off Brazil. Their biggest hopes, however, are pinned on Russia, which opened up to private investment in oil under Boris Yeltsin and saw a surge in investment and production.

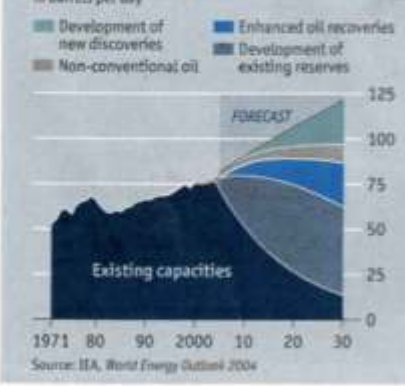
Lord Browne: one of the opportunity-poor

Unfortunately, this new wave of oil exploration is likely to prove trickier than the first. For a start, it usually involves technically complex oil formations that require lots of high technology and up-front capital expenditure. Moreover, the legal framework in some of the countries concerned can be unreliable. For example, Venezuela is now trying to change existing contracts.

Russia seems to have removed the welcome mat to outsiders of late. Investors liked to think that Vladimir Putin's destruction of Yukos, the country's biggest private oil company, supposedly for tax fraud, was a special case. Lord Browne, whose firm owns half of TNK-BP, the largest foreign oil presence in Russia, insisted last autumn that the political risk he faced in Russia was no greater than anywhere else. But in February this year the Russian government announced a ban on majority foreign participation in many new natural resource concessions, and in April it pro-

Changing the mix 3

Global oil production by reserve category
m barrels per day



Source: IEA, *World Energy Outlook 2004*

sented TNK-BP with an arbitrary $1 billion tax bill.

Still, Russia sits atop only about 5% of the world's oil reserves. And even though at the moment it is cranking out nearly 10m bpd, roughly the same as Saudi Arabia, it will not be able to keep it up.

Hands off our oil

The biggest obstacle the majors face in replacing their reserves is the fundamental perversity of the oil business. Oil is the only industry in which the best and largest assets (in this case, oil and gas reserves) are not in the hands of the most efficient and best-capitalised firms (the western majors), but of national oil companies (see table 4, next page). Two-thirds of the world's oil reserves are found in the Persian Gulf, where foreign firms are mostly unwelcome. Exxon may hold the highest stock valuation among listed firms, but it is dwarfed by Saudi Arabia's unlisted Aramco, whose oil reserves are 20 times larger—and off-limits to foreigners.

A chief rationale for the recent mergers was that only super-majors can afford to spend the sort of money that might help them bag various giant oil prospects. Morgan Stanley's Mr Terreson, an early champion of the super-major thesis, now concedes: "I guess that part of the thesis didn't work out as we planned. Bigger size has not produced bigger projects yet." Still, he insists the mergers were not a mistake.

They may, however, have set up Big Oil for an even bigger fall in years to come. Many countries that were once the stomping grounds of the Seven Sisters have developed home-grown oil companies that, with help from western oil-service companies such as Halliburton and Schlum-

The incredible shrinking companies

The way oil reserves are booked needs reforming

RESERVES proved fatal for the career of Sir Philip Watts, Shell's former chairman, who lost his job amid accusations of having "booked his way to the top" by inflating the firm's reserve figures. But the latest financial disclosures from the majors suggest problems with reserves were nothing unusual. Even mighty Exxon failed to replace all its reserves last year, and Chevron's reserves shrivelled to less than a fifth of their size a year earlier.

In reality, things are not nearly as bad as they sound. Most of the apparent shrinkage has more to do with inadequacies in America's financial regulations governing oil-company reserves than with a lack of oil. In particular, the Securities and Exchange Commission's rules on what proportion of a company's hydrocarbon holdings can be booked as "proven" are arbitrary and overly restrictive. A thoughtful report from CERA, an oil consultancy, explains that these rules were formulated at a time when American officials worried about the country running out of oil and gas, and asked firms to book only those reserves that could get to market with "reasonable certainty".

The principle sounds sensible, but the specifics are not. For example, oil companies are required to recalculate the viability of their reserves each year, using the oil price at year-end. Never mind that no oilman plans his investments using that arbitrary price. In 2004, the price of heavier grades of crude oil collapsed at the end of the year. Even though that proved a brief and unrepresentative blip, firms listed on American stockmarkets had to write off vast quantities of reserves on paper.

Nor have American regulations kept pace with technological innovation. For example, when the oil industry operated only onshore, it made sense to require firms to establish the physical presence of oil by drilling lots of wells. In ultra-deep water, however, wells can cost $30m to $40m apiece. Experts say 3D seismic data and well logs are sufficient to establish the presence of oil, without the need for elaborate test wells. The SEC recently agreed to allow this modern approach—but, absurdly, only in the Gulf of Mexico.

Let the sunshine in

Clearly, American regulators need to modernise their rules, but so far they have been dragging their feet. *Petroleum Intelligence Weekly*, a leading industry publication, has put forward a controversial proposal: that the majors voluntarily disclose data on all their reserves, broken down field by field across the world. The global mining industry already runs a similar scheme.

OPEC figures are even murkier than oil-company accounts, but there is growing pressure on governments to be more open about their reserves too. Matt Simmons, a Texan investment banker who claims that Saudi oil fields are running down much faster than their owners admit, demands that OPEC countries also disclose field-by-field data. Many oil companies do not even break down their results by country. They claim that such disclosures would give away sensitive commercial information or break confidentiality clauses with government partners. Governments fret that their national sovereignty would be put at risk.

Yet as long as the rules apply to all companies, it is hard to see what harm they would do. Individual firms already have these data available, and readily disclose them to banks or to potential merger partners. And given some of the national oil companies' shameful record of corruption and abuse of oil revenues, sovereignty as a reason for non-disclosure does not wash either.

Far from losing out, companies and their shareholders may benefit from greater disclosure. Financial analysts say that Big Oil's murky accounts are raising its cost of capital. The Boston Consulting Group's Phillip Ellis insists that "transparency would lead to a dramatic change in how investors view oil companies. In time, it would expose the long tail of non-performing assets in their portfolios."

As for OPEC countries, they would benefit from refuting claims that they are running out of oil. Saudi Arabia insists its reserves are healthy. Mr Simmons's claims to the contrary are unnerving investors and making prices more volatile. He may well be wrong about Saudi decline rates, but he is surely right in saying that: "With more transparency, any analyst can decide whether we have plenty of oil left or if we've already peaked. We are now flying totally blind."

berger, have access to modern technologies. Some of these national oil companies (NOCs) are now bidding for oil and gas concessions overseas. They do not always play by the same rules as publicly listed companies, and sometimes they beat the majors at their own game.

Fu Chengyu seems the very model of a modern major's general. The chairman of the China National Offshore Oil Corporation (CNOOC), a partially privatised energy firm, likes to hold early-morning meetings at his modern headquarters in Beijing. He peppers discussions of corporate strategy with vows of "shareholder value" and "healthy returns on capital".

But do not be misled by Mr Fu's western ways. He is a proud Chinese nationalist who believes that his country's resources are best cultivated by local companies like his, and roundly rejects the majors' argument that developing countries need them for access to technology and capital: "Technology I can get. Money I have. But if you don't have reserves and production, nobody can help you."

Such swagger used to be limited to a small handful of NOCs in the Middle East, especially Saudi Aramco, but no longer. Indian and Chinese government oil executives are now spending billions of dollars on a global scramble for oil and gas to feed their booming economies. Behind Russia's clumsy crackdown on Yukos lies an audacious plan to turn the state-run Gazprom into a national oil and gas champion. In Venezuela, Hugo Chavez has installed political allies in key management jobs at PDVSA, the state oil monopoly, and now talks of forging a pan-Latin American "Bolivarian" oil company.

Why is resource nationalism on the rise? One explanation usually offered is "energy security", a woolly and much-abused notion. Since September 11th 2001, goes the argument, the energy world has been much riskier than it was during the go-go 1990s, when governments were largely content to leave it to the markets to match up supply and demand. Now, say strategists in big consuming economies such as China, countries need to lock in "equity oil" to have peace of mind.

Countries with lots of hydrocarbons, for their part, are increasingly clamping down on foreign or private investment. Amy Jaffe of Rice University, who has studied past oil nationalisations in Iraq and Iran, argues that these were driven as much by economics as by ideology. She worries that today's resource nationalism in places such as Venezuela and Russia could be more ideologically motivated.

There is just a chance that today's high-minded nationalists are merely opportunists taking advantage of high oil prices. One Chinese expert insists that companies heading overseas are just empire-building. Similarly, one Russian oil oligarch says that "perhaps some officials really want a national oil company, but this is mostly guys enriching themselves, wrapped in the national flag."

Oddly enough, the biggest losers from the rise in oil nationalism may be the citizens of countries blessed with hydrocarbons. Historically, where governments have played a prominent part in developing oil resources, energy firms have often turned out corrupt and inefficient. There are exceptions, of course: Malaysia's Petronas and Norway's Statoil, for example, are pretty well run. On the whole, though, the oil bounty tends to get misspent, and the poorest citizens of the countries concerned rarely see the benefits, a phenomenon known as the oil curse. Ordinary Venezuelans, for example, are poorer than they were 30 years ago, despite the hundreds of billions of dollars their country has earned from oil; and Nigeria is famous for its oil-fired corruption.

A more obvious loser is the global energy consumer, who may have to endure higher prices over the long term if NOCs in OPEC—or those from countries such as Mexico and Norway that shadow the cartel—increase their market share at the expense of the majors. Official American estimates suggest that over the past 30 years OPEC's machinations transferred over $7 trillion in excess profit from consumers to producers. And the cartel's coffers are still overflowing: OPEC's oil-export revenues have shot up from about $100 billion in 1998 to perhaps $340 billion last year.

Oil's rich list 4

Top 20 oil companies, by reserves, 2003

		State ownership, %	m barrels
Saudi Aramco	Saudi Arabia	100	259,400
NIOC	Iran	100	125,800
INOC	Iraq	100	115,000
KPC	Kuwait	100	99,000
PDV	Venezuela	100	77,800
Adnoc	UAE	100	55,200
Libya NOC	Libya	100	22,700
NNPC	Nigeria	100	21,200
Pemex	Mexico	100	16,000
Lukoil	Russia	8	16,000
Gazprom	Russia	73	13,600
Exxon Mobil	US	-	12,900
Yukos*	Russia	-	11,800
PetroChina	China	90	11,000
Qatar Petroleum	Qatar	100	11,000
Sonatrach	Algeria	100	10,500
BP	Britain	-	10,100
Petrobras	Brazil	32	9,800
Chevron Texaco†	US	-	8,600
Total	France	-	7,300

*Now in effect controlled by government
†Does not include newly acquired Unocal

Source: Petroleum Intelligence Weekly

The anti-OPEC

A private oil industry is essential if future OPEC abuses are to be checked, especially as the world's remaining reserves are highly concentrated in the Middle East. So it is a pity that the biggest loser of all from the rise of resource nationalism looks to be Big Oil. NOCs are increasingly doing battle with the majors outside their home turf, enjoying unfair advantages arising from their quasi-government status. One oilman calls this the coming age of "asymmetric warfare".

Because state-controlled firms do not have to meet the same standards of transparency as publicly listed ones, nobody knows their true financial status. Most operate with "soft" budgets, in the knowledge that their state parents will supply capital when needed. Anecdotal evidence suggests that government-run firms sometimes overpay for assets in order to edge out majors.

NOCs also need to worry less about environmental and human-rights campaigners. When activists forced Canada's Talisman Energy to stop doing business with Sudan's thuggish government, a Chinese firm happily snatched up the oil concession. And Indian NOCs can operate in places such as Myanmar, which majors tend to avoid. American officials have been scolding India over gas deals its NOCs have recently signed with Myanmar and Iran.

Even in countries that do not have a lot of reserves, the playing field is increasingly tilted toward the locals. For example, the majors are desperate to sell petrol to China's billion-plus consumers as car ownership becomes more widespread, but they may not get the chance. One ominous sign was a fiasco over a gas pipeline from China's far west to Shanghai, which Exxon and Shell were going to help build in return for access to the Chinese market. But they were offered such unattractive terms that they pulled out; state-run PetroChina is completing the job by itself.

"China has 1.3 billion consumers, just like Russia has vast quantities of oil and gas, but neither is going to give them up to foreigners. China wants technology, but then will spit them out," says David Hurd of Deutsche Bank. The Russian oiligarch concurs, pointing out that BP would now be unable to conclude the deal in which it bought half of Russia's TNK.

So will the rise of NOCs prove the final nail in the coffin for the once-proud Seven Sisters? The head of exploration for a super-major thinks that within five years the industry will see another big wave of consolidation.

Given the rising cost of finding and developing oil, analysts reckon that it might be cheaper for the majors to add reserves by "drilling on Wall Street" (that is, buying one of the mid-sized companies) than looking for oil in the ground. In early 2005, Chevron took over Unocal, a mid-sized American oil company, beating China's CNOOC and Italy's ENI to the draw.

However, some pundits think that even consolidation will not save the majors, and that the once-proud giants may have to reconcile themselves to shrivelling up over time as they fail to replenish reserves. They would be "hollowed out" into technology companies not unlike today's Halliburton or Schlumberger, and become mere handmaidens to the NOCs.

How to survive

But do not write the majors off just yet. They are remarkably resilient, as their rebound from the nationalisations of the 1970s proved; they are still capital-rich; they command the top talent in the business; and they can still claim to have the edge in technology.

Any survival strategy for the majors must centre on technology, for two reasons. First, this is an area where they already have an advantage over the NOCs. Second, the majors are likely to be banned from developing the cheapest and easiest reserves, which leaves them with trying to squeeze extra oil from difficult reservoirs.

With much of the conventional resource base closed to them, the majors are increasingly looking to "unconventional" hydrocarbons—at which they used to turn up their noses. The best example is Canada's tar sands, mucky hydrocarbons that are much more difficult, expensive and environmentally damaging to convert into petrol than ordinary oil deposits. In theory, there is more energy in Alberta's tar sands than in all the oil in Saudi Arabia, but getting it out has proved so problematic that production remains a trickle.

The charms of Sakhalin

All the same, most of the majors are now ploughing big money into tar sands, shale, coal-bed methane and similar projects. Indeed, Exxon's Mr Raymond recently vowed to invest sufficient resources to "turn unconventional oil into conventional oil" over time. Simon Henry, a director at Shell's exploration and production arm, says that within a decade, unconventional hydrocarbons could make up over a fifth of his company's total resource base.

Another big growth area for the majors is natural gas. That is ironic, for gas was once seen as so worthless that wags quipped: "Find gas once and you're forgiven; find it twice and you're fired." Using natural gas to make electricity produces less local pollution and contributes less to global warming than burning oil or coal, which greatly adds to its attractions.

The majors have the edge over NOCs in developing gas because it is capital- and technology-intensive; getting it to market from remote places requires compressing and cooling it, and shipping it as liquefied natural gas (LNG). Unlike oil, which can be sold easily in the world market, gas needs to be marketed to end-use customers to be worth anything.

The most spectacular gas project now under way is in the Russian island of Sakhalin, just 25 miles north of the Japanese island of Hokkaido. In the rest of Russia, Gazprom, the inept and corrupt state gas monopoly, controls gas resources through its domination of the country's gas pipeline network. But Sakhalin is so remote that gas has to be shipped as LNG, not by pipeline, so the Russians have asked several international firms to help them develop the deposits.

Sakhalin Energy, a project led by Shell, plans to ship Russian gas as LNG to both Japan and China, offering a market-based, technology-led solution to the geopolitical squabbles over which of those two Asian giants will get access to Siberian energy. In fact, Sakhalin Energy has signed contracts to ship Russian gas to America's west coast via a new LNG regasification terminal in Baja California, Mexico, so Russian gas will be able to reach the whole world.

The future of the majors lies in big, technically complex integrated projects of this sort, argues Mr Ellis of the Boston Consulting Group. In the past, the majors have scoffed at big integrated gas, petrochemical and power projects because they tend to produce lower rates of return than do upstream oil investments. But the majors may no longer have a choice. If they want access to other countries' hydrocarbon reserves, they will have to offer skills that the NOCs tend to lack, such as project integration and downstream marketing.

If oil prices drop, the majors and the NOCs might even get together. David Victor of Stanford University says the NOCs "are usually so grossly inefficient" that their grand ambitions and hostility to foreign investment might crumble in the face of lower revenues. The majors, for their part, could hasten that day by changing their attitude. In the past, they have insisted on majority ownership of assets and high returns on capital—"skimming the cream", in industry jargon. In future, they may need to woo their targets more. As Christophe de Margerie, head of exploration and production for Total, puts it, "You can no longer just say, 'I am the king', and expect countries to give up their resources. You have to bring a win-win package, offering things like electricity generation, refining systems, training. You need to be sexy."

Conversely, a sharp rise in oil prices could also help to expose the folly of resource nationalism. The biggest lesson from the failed Arab embargo of the 1970s is that oil is a fungible, global commodity: a shock in one place sends prices soaring for everyone, everywhere.

Even CNOOC's Mr Fu, who wants to see Chinese firms flourish at home, believes that their current infatuation with going overseas for "equity oil" is misguided. He thinks the government backing that is so welcome to NOCs today may eventually backfire. The best prospects, he notes, may come not from China's friends but from countries that are not friends.

The biggest fear of every oil company, whether private and public, is that sooner or later the oil may run out. Will it? ■

The bottomless beer mug

Why the world is not running out of oil

"OIL is found in the minds of men." So says a popular bumper sticker in America's oil patch. There is something in that. Daniel Yergin, author of "The Prize", a Pulitzer prize-winning history of oil, argues that the history of oil is one of astonishing innovations. In 1859, Colonel Edwin Drake struck oil in Pennsylvania by drilling rather than digging, adapting the old Chinese trick of drilling for salt. That prompted the world's first oil boom, which inevitably led to bust as oil flooded the market and prices collapsed.

In 1901, another set of unlikely innovators struck oil in unpromising terrain at Spindletop, Texas. They used novel drill bits that rotated through the earth rather than merely pounding it, enabling them to reach far greater depths. This started up a ferocious gusher that spewed out nearly 1m barrels of oil in ten days. It marked the birth of the modern oil industry. Inevitably, this boom once again led to bust as oil grew ever more plentiful.

And yet, despite this history of innovation and abundance, concerns about depletion are once again clouding the industry's future. This time round, argue the doomsayers, depletion really is looming, and technology will not come to the rescue, as it has done in the past. If they are right, today's oil prices are but a harbinger of much, much worse to come.

Clearly, oil is a non-renewable resource that has to run out some day. Those who expect that day to come sooner rather than later usually point to Hubbert's peak. M. King Hubbert was a geologist at Shell who predicted in 1956 that America's oil production would peak and begin to decline in the early 1970s. In fact, oil production from the 48 contiguous states did peak around 1970. The current debate on depletion is about when the global "Hubbert's peak" will be reached.

The United States Geological Survey did a comprehensive study in 2000 and concluded that such a peak was at least two decades off. The IEA broadly concurs, arguing that oil supplies will not become constrained until after 2030, provided the necessary investments are made. However, some analysts disagree sharply.

The leading lights among the petro-pessimists are Colin Campbell and Jean Laherrère. In a much-quoted article in *Scientific American* in 1998, they predicted that the global Hubbert's peak would be reached around now. There has been a flood of gloomy books with such titles as "Out of Gas" and "The End of Oil". And Mr Simmons, the petro-pessimist investment banker, is bringing out a book in May that questions the sustainability of production in Saudi Arabia.

All found?

In essence, the pessimists say that there is a fixed amount of oil in the ground to be found, and that mankind has found it already. According to Jim Meyer of the Oil Depletion Analysis Centre, a British think-tank, "Discovery clearly peaked in the 1960s. We are out of North Seas." He argues that annual oil consumption has exceeded new discoveries since the 1980s, indicating that the world is running down its stock of "found" oil, and reckons that 18 major oil-producing countries, currently making up about 30% of world output, are now past their peak.

Given that oil companies have poked and prodded the entire Earth (save Antarctica) for over a century, goes the argument, there cannot be any more "supergiant" fields such as Saudi Arabia's Ghawar, which alone produces 5m bpd. Mr Campbell has neatly summarised this view of the problem: "Understanding depletion is simple. Think of an Irish pub. The glass starts full and ends empty. There are only so many more drinks to closing time. It's the same with oil. We have to find the bar before we can drink what's in it."

But this argument is wrong both on a philosophical and a practical level. The philosophical problem, says Michael Lynch of Energyseer, a consultancy, is that the pessimists treat the level of recoverable oil resources as fixed—like the amount of beer in that mug. In fact, expert estimates on the ultimate recoverable resource base have consistently grown over the past few decades, even though the world has been guzzling oil as if there was no tomorrow (see chart 5, next page).

Peter Odell of Rotterdam's Erasmus University points out that "since 1971, over 1,500 billion barrels have been added to reserves. Over the same 35-year period, under 800 billion barrels were consumed. One can argue for a world which has been

Drowning in it?

'running into oil' rather than 'out of it'."

What makes the estimates go up continuously is a combination of economics and innovation. The IEA explains the process this way: "Reserves are constantly revised in line with new discoveries, changes in prices and technological advances. These revisions invariably add to the reserve base."

A few decades ago, the average oil recovery rate from reservoirs was 20%; thanks to remarkable advances in technology, this has risen to about 35% today. But despite this improvement, two-thirds of the oil known to exist in reservoirs is still abandoned as uneconomic, leaving room for tomorrow's discoveries or innovations to lift recovery rates and magically push the global Hubbert's peak even further towards the horizon. Pundits had predicted that fields in the British North Sea would reach their maximum output by 1990. In fact, they have only just peaked.

Dozens of similar examples from around the world added up to defy Mr Campbell's prediction of a global Hubbert's peak by now, which plainly has not materialised. Indeed, even the legendary Hubbert did not get it quite right. His forecast for the American production ignored the vast quantities of oil that lie under the deep waters of the Gulf of Mexico. That may seem an unfair critique, as he had no way of knowing about the wave of offshore drilling technologies that have become available in the past decade. But that is the point: today's pundits cannot foresee tomorrow's innovations.

Petro-optimists say the future for oil is bright. Mr Odell argues in a recent book, "Why Carbon Fuels Will Dominate the 21st Century's Global Energy Economy", that conventional oil will not peak until nearly mid-century, and that unconventional oil resources such as Canada's tar sands will peak only at the end of this century. Morris Adelman of the Massachusetts Institute of Technology has even argued that the "amount of oil available to the market over the next 25 to 50 years is for all intents and purposes infinite."

A new age of discovery

But there is a more practical fallacy embedded in the gloomy forecasts too. "I challenge the idea that the era of discovery is over in oil," says Total's Mr de Margerie. Thanks to the cold war and other political constraints on western investment, much of the world has yet to be explored with the aid of the latest technologies.

Russia is a good example. When it opened up to private investment under Mr Yeltsin, it saw a huge inflow of modern technology and management talent, causing a dramatic leap in production—which has now been put in jeopardy by Mr Putin's crackdown on the sector.

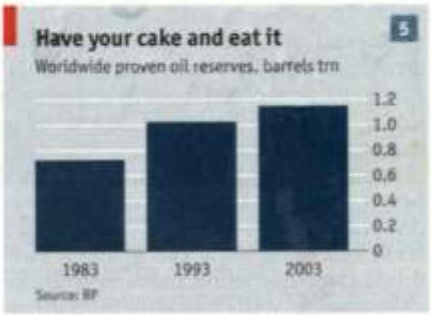
Similarly, other parts of the world are still "under-rigged" and under-examined. According to Mr Fu, CNOOC's chairman, "our offshore prospects are just beginning. A promising area the size of two North Seas has yet to be explored." When India recently liberalised its oil-exploration sector, Britain's Cairn struck oil in Rajasthan soon afterwards. V.K. Sibal, India's director-general for hydrocarbons, expects much more, "maybe even a super-giant deep offshore somewhere near the waters off Myanmar."

The unexplored potential in the Middle East remains vast. Pete Stark of IHS Energy, a leading consultancy on exploration, says that Iraq has over 130 undrilled prospects, and expects its proven reserves to rise sharply over time. Neighbouring Saudi Arabia has about 260 billion barrels of proven oil reserves today. Mr Naimi, the oil minister, is confident that current and future technologies will help lift that figure by 100 billion barrels in the next few decades, and points to an unexplored region on the Saudi-Iraqi border which alone is the size of California.

Total's Mr de Margerie points to frontiers that will be opened up by technology: "There may not be any more glamorous Ghawar fields, at least onshore, but there is tremendous opportunity if we look at 'deep horizons'." He believes that there are large deposits 10,000 metres (32,800 feet) or more underground. The snag is that they are usually under very high pressure or very hot, and may be extremely acidic. But as technology improves, he thinks, "these very strange hydrocarbons" will become economic.

Already, the industry is exploring under water at depths that were unimaginable a decade or two ago. In the Gulf of Mexico and elsewhere, oil rigs now float atop 3,000 metres (10,000 feet) of water. These marvels of engineering are stuffed with the latest in robotics, electronic sensors and satellite equipment. Using fancy "multilateral" wells that twist and turn in all directions, they can hit giant underwater oil pockets miles away from the rig.

In short, there are lots of frontiers left. Yet even if there is plenty of oil still available under the ground, getting it to market will pose huge problems. It will take lots of innovations, as well as courage and capital, to move it to where it is needed.



That points to the petro-pessimists' second great doubt: that the oil industry has run out of techno-fixes. They say that technological advances such as multilateral wells are a mixed blessing because they cause reservoirs to be depleted faster; that there are no more "killer applications" like 3D seismic reservoir-imaging technology left to transform the industry; and that the majors have largely abandoned the vital task of investing in upstream research and development in recent years, as part of a misguided cost-cutting drive.

Petro-pessimism

This is a more serious critique than the one about Hubbert's peak, because it cuts to the heart of what will make or break the oil majors. But Mr de Margerie challenges both strands of petro-pessimism: "The peak will come, but we can keep the plateau for a long time with technology." So who is right?

First, consider the idea that technology could be a mixed blessing. It is true that in some fields the majors have recently found that investments in the latest technologies pushed up output and led to faster depletion. Critics argue that these technologies merely act as fatter straws, helping to suck out more liquid but ultimately emptying the glass faster too.

Roger Anderson of Columbia University has looked for this alleged "faster depletion effect" in over 40 oil and gas fields, using the latest innovations, and found no evidence for it. "The more prevalent problem", he says, "is not that there is faster depletion, it is that oil companies desperate to get the black gold into the bank are ignoring modern asset-management techniques." He points to firms using advanced "4D" seismic production technologies but failing to tie production of oil and gas to the market and price conditions prevailing at the time.

Besides, the underlying assumption that the recoverable reserves are fixed

might be wrong in itself. A fatter straw could end up producing more oil both now and later if the resource base is dynamic. In most cases, modern techniques clearly prolong a field's life and increase the recoverable reserves.

Andrew Gould, chairman of Schlumberger, points out that 25 years ago only one-sixth of all exploration wells drilled were successful; now the figure is two-thirds. Over that period, the success rate for development wells has gone from hit-or-miss to nearly 100%. He is convinced that the future lies in embedding digital technologies such as down-hole sensors, real-time communications equipment and other kit that will make for the smart oil field of the future.

Companies already use some of these techniques when they drill wells, but he thinks they should apply them to monitoring the wells right from the start. "Progressive illumination" was the management philosophy of the past: "You learned as you went along. Now you draw a much better picture up front, and monitor the reservoir carefully from day one." Private companies do not want to spend such money up front, at least not yet, but he speaks approvingly of Saudi Aramco's long-term thinking.

High-tech desert

Rising out of the windswept deserts of eastern Saudi Arabia is a petroleum visualisation centre on a par with the best in Houston. Backing it up is a bank of computers with more data-storage capacity than America's NASA. Unlike most private companies, Aramco has invested in observation wells that monitor its reservoirs in real time. Mr Jumah, the firm's boss, explains that he can check on what is happening deep underground in a well hundreds of miles away from his laptop computer. The company's geologists say this monitoring technology allows them to act quickly to ward off the problems of field decline to which Mr Simmons has drawn attention.

What about the argument that there are no breakthrough technologies left to transform the oil business? On one estimate, the net benefit to the global oil industry from 3D seismic imaging (through reduced drilling costs, more exploitation and so on) amounts to $11 billion a year. But there is no obvious blockbuster technology to follow it, though some lesser ideas are being investigated. For example, Exxon and Schlumberger are looking into whether adding electromagnetic analysis to seismic soundings can improve the visualisation of reservoirs, and Apache is investing in technology that allows three-dimensional visualisation without the need for big amphitheatres or special goggles.

Peter Robertson, vice-chairman of Chevron, says that he "would not bet the company on a new 3D seismic". But he is convinced that incremental technologies matter because they can help lift recovery rates by a few percentage points and improve recovery in existing fields: "Flattening the decline curve could mean more than even a big new discovery."

David Lesar, Halliburton's boss, has not given up hope for a breakthrough. He argues that "when 3D seismic or directional drilling first came, nobody saw their potential. It was the unexpected application of those technologies that was key." He thinks today's innocuous technologies could prove tomorrow's breakthroughs, as long as the industry continues to encourage innovation.

That points to the most explosive criticism levelled at the oil majors: that they no longer have the capacity to innovate. A few decades ago these firms were fiercely proud of their proprietary technologies, which they believed gave them a competitive edge. But during the 1990s most majors slashed funding in this area, leaving service firms such as Schlumberger and Halliburton to pick up the slack.

"Ten-dollar oil killed upstream research," says one executive. Ivo Bozon of McKinsey, a consultancy, reckons that the majors slashed upstream R&D spending from $3 billion in 1990 to below $2 billion in 2000 (both in current dollars). Over the same period, the service companies increased their investment in research from $1.1 billion to $1.7 billion. The sharpest cuts, adds Mr Bozon, were made by American companies.

"These guys need to explore, but they don't know how to do it any more," complains Roice Nelson of Geokinetics, which makes reservoir visualisation software for the oil industry. Mr Nelson helped found Landmark Graphics, an industry pioneer in imaging software, so his criticism stings. He notes that the industry sacked many of its best-qualified technical staff, and that relatively few college students now are going into petroleum engineering. "We'll be working till we're past 80," he sighs.

The majors now realise that this shift away from technology, once their core strength, was a mistake that has benefited three groups of rivals: the service companies, the "mini-majors", and the NOCs. Mr Lesar at Halliburton is delighted: "There's been a fundamental shift in ownership and development of technology from the majors to the service companies." The problem is that the service companies are less capable of investing for the long term, because their balance sheets tend to be weaker than the majors'. Moreover, they need their customers to adopt those technologies to make them commercially viable—but the majors have proved gun-shy.

The shift in innovation has been a boon to smaller oil companies, which are not so risk-averse. Especially since the wave of mergers, the majors need mega-projects with long lives to replace reserves. That has made them wary of trying new technologies. Chevron's Mr Robertson says that taking a flier on a project with a long lead time and high investment is simply too risky for his firm. Mr Farris, Apache's chief executive, takes quite a different approach: "We go to the service companies and say, 'What have you got?' Hell, we'll spend money to try it."

The rise of the indies

All this hurts Big Oil in another way: the NOCs no longer need them to get access to modern technology. The more sophisticated NOCs, like Saudi Aramco, buy technology directly from the service companies, but many others are turning to the smaller, independent majors, known as "indies", for help.

Jim Hackett, chief executive of America's Anadarko, explains that with a market capitalisation of $20 billion and a capital budget of $3 billion a year, his firm is big enough to challenge the big boys: "I can't compete with Exxon in 20 countries, but I can beat them in a few." Aside from their speed of decision-making and their readiness to embrace new technologies, he thinks that resource nationalism gives the smaller western oil firms an advantage. "We are no threat, we have no baggage of the Seven Sisters. Sometimes locals don't even know that we are an American firm."

Whether the majors will regain their skills as technology innovators is an open question. Exxon, for one, is making a big push. The firm spends some $600m a year on upstream R&D, more than its rivals, and sees technology as the key to unlocking future reserves.

The rise of the NOCs and resource nationalism ensures that the majors will not have cheap and easy pickings in future. If they are to survive, they must adapt and change—and perhaps even move beyond petroleum, as the next section explains. ■

Consider the alternatives

Is the age of oil drawing to a close?

"CONSERVATION may be a sign of personal virtue, but it is not a sufficient basis, all by itself, for a sound, comprehensive energy policy." So declared Dick Cheney, America's vice-president (and former boss of Halliburton), in 2001 as he defended his administration's new energy policy. That policy still aims to bolster energy independence from OPEC by boosting domestic supplies, including oil found in protected parts of Alaska.

Alas, America will never achieve energy "independence", given that it consumes a quarter of the world's oil but has less than 3% of its proven reserves. A boost to its output will make little difference to the global energy equation, and its energy plan does little to encourage greater fuel economy in cars or gas-guzzling sport-utility vehicles.

That is a pity, for history shows that curbing demand can be a powerful check on the OPEC cartel. After the oil shocks of the 1970s, the developed world introduced powerful policies to encourage energy efficiency. In Europe and Japan, these took the form of energy taxes; America chose instead to regulate the car industry through the Corporate Average Fuel Economy (CAFE) law.

At the time, energy use and economic output were thought always to grow in lockstep. Amory Lovins, head of the Rocky Mountain Institute, a natural-resources consultancy, argued that there was an alternative "soft path". He was widely ridiculed, but the 1980s proved him right. Thanks chiefly to government policies, growth in the rich world's energy use and GDP decoupled, and the OECD countries became much more energy-efficient (see chart 6, next page).

The biggest success was the CAFE law, which between 1978 and 1987 produced an improvement of over two-fifths in the average fuel efficiency of new American-made cars. Between 1977 and 1985, the volume of America's net oil imports fell by nearly half even as its economy grew by a quarter. Mr Lovins believes this broke OPEC's pricing power for a decade. The world enjoyed low and stable oil prices in the late 1980s and much of the 1990s.

All this shows that government energy policies matter. As this survey has argued, today's high oil price is not causing a shock of the sort seen in the 1970s. Even so, governments would be wise to bring in policies that speed the end of the age of oil.

But why, ask oilmen, when oil has served the world economy so splendidly over the past century? The iron nexus between the internal-combustion engine and petrol has indeed been vital to the extraordinary economic expansion seen in the 20th century. But now the oil industry has to contend with two powerful forces for change: greenery and geopolitics.

Concerns about oil's impact on local pollution and human health are nothing new, and CERA's Mr Yergin argues that the oil and car industries have dealt with them successfully through technologies such as catalytic converters and low-sulphur petrol: "They have shown that they can deal with smog: today's cars are 98% cleaner than those from the 1970s on conventional pollution."

However, the internal-combustion engine will never be able to overcome the problem of carbon emissions, which are an unavoidable side-effect of burning petrol. Mr Yergin believes that the growing popular pressure for governments to tackle global warming poses a serious challenge to the oil industry.

Alaska's huskies look the other way

An even more powerful reason for governments to promote alternatives to oil comes from geopolitics. As the "fear premium" on the oil markets has shown, the oil world has become increasingly volatile. Every official forecast shows that the Persian Gulf's share of the oil trade will grow inexorably over the next two decades, so the risk of terrorist attack, embargo or economic shock is bound to rise. The likeliest sources of trouble outside Saudi Arabia are the frenetically busy Straits of Hormuz, in the Middle East, and the Straits of Malacca in Asia.

The 1970s oil shocks prompted the rich world to switch from petroleum to other fuels for such things as power generation. But there are no viable alternatives to the motor car, so the share of the world's oil going to transport has risen sharply. That has left the world dangerously vulnerable to the next oil shock. Oil use is now concentrated in a sector that simply cannot live without it.

There is clearly a strong case for governments to start weaning their economies off oil. But how? The most radical idea is to rethink transport completely so that at least in urban areas (where the majority of mankind now lives) there is much less need for individual cars. Mobility would be provided by trains, subways and ride-sharing schemes instead. Perhaps in future, enlightened urban planners will design cities with cheap and convenient public transport in mind. Alas, that time has not yet come: just look at China.

As soon as ordinary Chinese become wealthy enough to buy a car, they happily abandon public transport. Shanghai's economic boom has been accompanied by an annual rise of 15% in the number of cars in the past few years, which explains the city's miserable traffic and smog. Officials have tried to curb this by introducing an auction system for new car permits, but have been taken aback by the demand. The price of new permits has shot up past $5,000 per car and is still rising.

In short, public transport is vitally important, but it will never dislodge the car. ▸▸

For the world's aspiring billions, it is the ultimate symbol of status and freedom, even if it perpetuates mankind's addiction to oil. That points to more practical ways to tackle petro-dependency: increasing efficiency and boosting alternative fuels.

CAFE culture

The first candidate for efficiency gains is America, land of the gas guzzler. CAFE was a success, but a loophole has allowed SUVs to dodge tight fuel-economy standards. The average fuel economy of new American vehicles is close to a 20-year low. Tightening CAFE would make sense, but a less market-distorting approach would be to raise America's pitifully low petrol taxes.

More importantly, a higher petrol price in America would send a strong price signal to the markets that efficiency matters. That would boost innovations such as hybrid drives, pioneered by Toyota, which are now slowly making their way on to the market. Hybrid cars use conventional petrol engines, but boost overall fuel economy through the use of a small electric motor at low speeds, as well as clever electronics that capture the energy generated in braking.

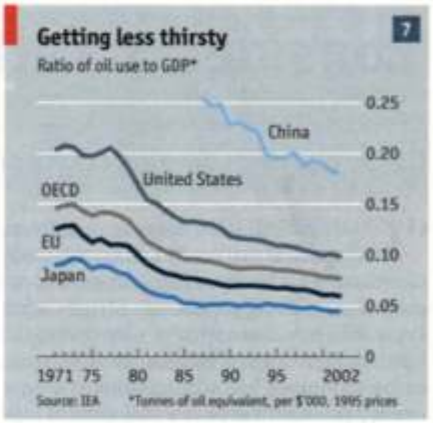
But boosting efficiency will not be enough, says Larry Burns, GM's head of research. He believes that the internal-combustion engine will at best become 25% more efficient over time, and hybrids may save a similar amount, but that the increased petrol consumption that comes with economic growth may wipe out these gains. The world will remain utterly reliant on oil: "Our industry is 98% dependent on petroleum to power our product, and we're very worried about volatility." That is why, he explains, his firm is keen on alternative fuels.

The current favourite is biofuels, typically made from renewable resources such as agricultural crops or waste. They are attractive not only because they are green, but because they can be blended into conventional petrol and used in today's engines. Brazil has a huge market for ethanol made from domestic sugar cane. Car companies are equipping vehicles with "flex-fuel" capability, so they can run on either petrol or ethanol blends.

All biofuels cost more than petrol, but some are egregiously wasteful. In America, making ethanol from corn usually takes more energy and creates more nasty emissions than burning the petrol it is meant to replace. And yet, thanks to the political power of mid-western farmers, the country spends billions of dollars on producing it. However, the next generation of "cellulosic" ethanol promises to be much greener. Iogen, a Canadian firm pioneering this technology, says America produces enough agricultural waste to put 10% ethanol into every petrol tank in the country. It expects to scale up its technology to a commercial prototype by 2008.

Another intriguing alternative to oil comes from natural gas. Gas-to-liquids (GTL) is the clunky name given to a set of fuels that can be blended into conventional diesel and used in today's engines. They have the advantage of being super-clean, as well as boosting the potency of diesel fuel. Though they can be made from coal or biomass, the most likely option is natural gas.

Jack Jacometti of Shell argues that of all the alternative fuels, GTL is already the cheapest, and the price is dropping as the quantity rises. His firm is planning a $6 billion GTL plant in Qatar, home to the world's third-largest gas reserves. Because this clean fuel happens to be made from natural gas, the oil majors do not see it as a threat. Indeed, it allows them to put some of their more inaccessible gas reserves to commercial use.



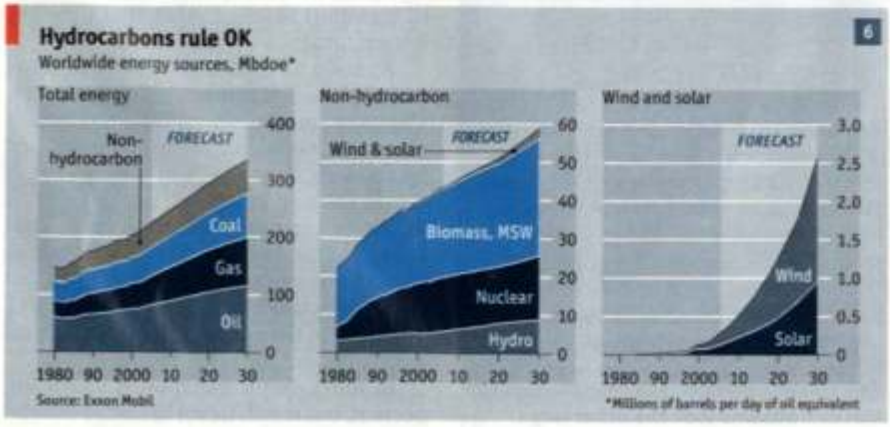
These blended alternatives may eventually help check OPEC's pricing power at the margin, but none is likely to make a real dent in oil consumption. To use them to best advantage, the IEA is urging governments to use smart subsidies that discriminate in favour of the greenest forms of biofuel. In the agency's most optimistic scenario, the OECD's biofuels consumption will rise 25-fold by 2030—but even then it will account for no more than 4% of worldwide transport-fuel consumption.

The emerging combination of hydrogen fuel and fuel-cell engines may go further. Fuel cells are essentially big batteries that combine hydrogen fuel and oxygen from the air to make electricity that can power anything from a laptop to a home or a car. The hydrogen can be made from any primary energy source, be it fossil fuels or wind energy.

The beauty of this combination is that it produces no local emissions, and if the hydrogen is made from renewables or coal with carbon sequestration technology (which captures the carbon emissions from hydrocarbon use and stores them underground), no greenhouse gases either. That is why, says GM's Mr Burns, "fuel cells will finally take the automobile out of the environmental debate." And because hydrogen can be made anywhere by anybody, no OPEC would hold sway.

Fuel cells will not come overnight, but the car industry is already pouring billions of dollars into developing them. GM plans to have fuel-cell technology ready for commercial use in 1m cars by 2010—provided the hydrogen filling stations are in place. Will the oil industry rise to the challenge?

It is not as daunting as it seems. If hydrogen is introduced in phases, as unleaded petrol was, the industry should be »



able to cope. Various studies have suggested that the cost of providing convenient access to hydrogen to a majority of Americans would be a few tens of billions of dollars, which sounds a lot but is actually quite a modest amount by the oil industry's standards. This would probably involve tapping into the natural-gas grid to make the hydrogen fuel, and putting hydrogen pumps into existing petrol stations.

A bit of everything

So which technology is the one to watch? "GTL, biofuels, hydrogen—everything is coming in a small way," says Ms Jaffe of Rice University. "The question is, will anything be a big winner and achieve market saturation? If you're Exxon, you're betting it will all be marginal."

And indeed Exxon forecasts that in 2030 internal-combustion engines will still make up over 95% of the world's vehicle fleet, and that oil will remain top dog (see chart 6, previous page). Mr Raymond, Exxon's boss, thinks renewable energy is "a complete waste of money". He has argued in the past that global warming is an unscientific notion perpetuated by government scientists in search of funding, though his company now tries to downplay such views.

Mr Raymond may well be the most successful oilman since Rockefeller himself. On one estimate, in his 12 years at the helm he has lifted his company's "economic value added" by $75 billion and its market value by $300 billion. However, it is just possible that he is underestimating the long-term risk that climate change and geopolitics pose to his firm. If governments become more determined to promote alternatives to fossil fuels, or if the new wave of private lawsuits and shareholder resolutions against oil companies over global warming turns Big Oil into the next Big Tobacco, then even a giant such as Exxon will feel the consequences.

There are already signs that a clean-energy revolution is getting under way. Whether prodded by low-carbon regulations or enticed by green subsidies, venture capitalists are pouring pots of money into low-carbon energy technologies, ranging from renewables to carbon sequestration. Even nuclear power, once thought dead, is getting a second look because it emits no greenhouse gases.

And it is not only start-ups that are making such investments. Giant GE, for instance, is now getting into the game in a big way. John Rice, the head of GE's energy business, says his wind division may have

Guzzling it in Shanghai

revenues of perhaps $2 billion this year—quite respectable for a technology that for many years was dismissed as hopelessly impractical. GE has invested in solar energy and fuel cells too. But it is also making a big push into nuclear power and "clean coal" technologies. Mr Rice explains that because of the uncertainty surrounding oil's future, "We take a portfolio approach: a little bit of everything."

If the majors want to stay on top, they too should take the threats to oil's supremacy seriously and start looking at alternatives. Sir Mark Moody-Stuart put it best a few years ago when he was chairman of Shell: "We need to meet our customers' needs for energy, even if that means leaving hydrocarbons behind." BP and Shell have done more than others, each setting up divisions to investigate renewable energy and hydrogen, but the amounts they are spending are still small compared with the money that goes on their oil and gas divisions. Environmentalists dismiss these efforts as "greenwash".

Even the most powerful man in the oil patch, Saudi Arabia's Mr Naimi, seems to acknowledge that his world is changing. Five years ago, when asked about the prospects for hydrogen, he immediately replied: "Hydrocarbons will remain the fuel of choice for the 21st century." Asked the same question again recently, he reflected before replying. He had been surprised by the size of the investment the global car industry is making in fuel cells, and he was concerned about efforts to tackle climate change, which he believed would hurt oil. Most revealingly, he said that his country was now looking into carbon-sequestration technologies. Eventually he got back to the question: "Oil will still dominate for the next 30-50 years, because there are no meaningful substitutes."

Old lags in the industry have long quipped: "The stone age did not end for lack of stone, and the oil age will end long before the world runs out of oil." Nowadays that sounds less like a joke and more like a forecast. ■

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