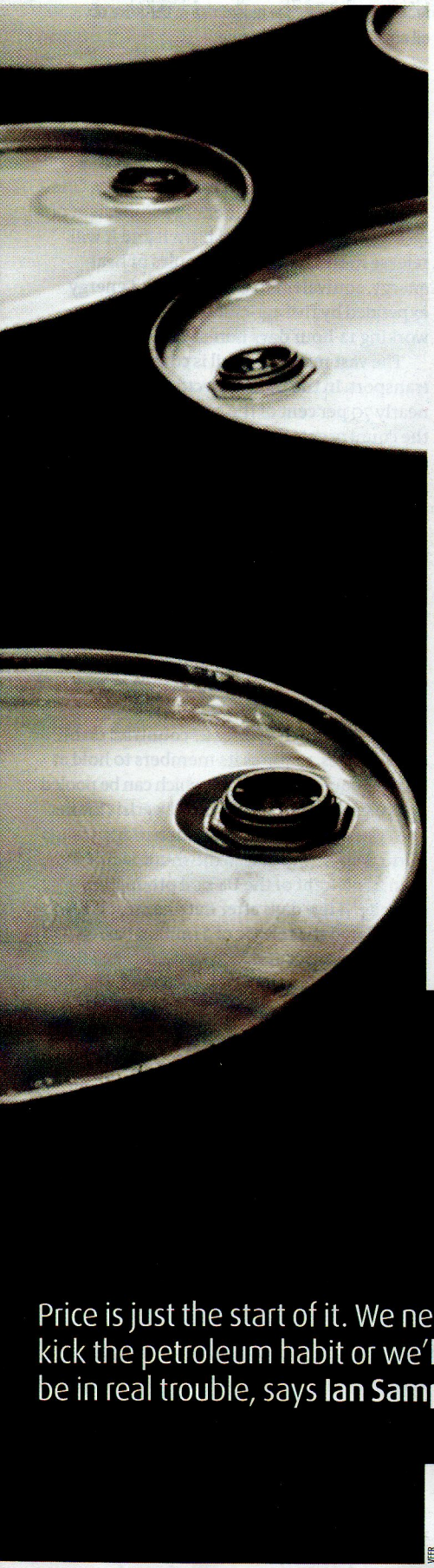
Final warning



Price is just the start of it. We need to kick the petroleum habit or we'll soon be in real trouble, says **Ian Sample**

HOWLS of protest have been echoing round the globe as the price of oil punches through record highs with every passing week. In the UK, last month, hundreds of truckers descended on London to demand that planned fuel tax rises be scrapped. In continental Europe, where police clashed violently with truckers, two people died during the protests. Fishermen and farmers blockaded ports and depots in protest against the rocketing cost of diesel. Similar scenes played out across South America and Asia.

In the US, the world's thirstiest oil consumer, gasoline reached an all-time high of $4 per gallon, forcing the administration to lean on domestic producers and consider suing foreign oil exporters for allegedly rigging the market. When President Bush implored Saudi Arabia, which controls the lion's share of the world's proven reserves, to pump more from its wells, the Saudis came up with only a token increase.

The situation is not about to improve. Bankers Goldman Sachs and Morgan Stanley have both suggested that the crude oil price could rise from the high of $139 a barrel (as *New Scientist* went to press) to $200 or more, while the financial speculator George Soros predicts that rising oil prices could send the US economy into recession.

Expensive fuel at the pumps is just the start. These battles over the price of oil could be the harbinger of something even scarier. There is a growing realisation that we are teetering on the edge of an economic catastrophe which could be triggered next time there is a glitch in the world's oil supply.

A number of converging forces are making such an event more likely than ever before. First, there is the spectacular rise in global oil consumption, which, according to the International Energy Agency (IEA) now stands at 87 million barrels of crude (about 10 billion litres) a day. Most geologists now accept we have reached, or will imminently reach, peak oil. Some fields in the US and the North Sea have been pumped dry and production is becoming increasingly concentrated within fewer countries. Add a boost from speculators betting that things will get even worse, chicanery by the Organisation of Petroleum Exporting Countries (OPEC) cartel which over the past two years has added Angola and Ecuador to its ranks to mask the decline in production of its existing members, and it's not hard to see why prices have been forced ever upwards. But price conceals the much more complex mess we're in.

In the past, it has usually been possible to ride out any disruption to world oil flows – whether from accidents or hostile acts – by pumping more oil from the ground. That spare capacity has now all but vanished, as oil producers cash in on soaring prices by extracting as much of the stuff as they can. "There is absolutely no slack in the system any more," says Gal Luft, executive director of the Institute for the Analysis of Global Security, a Washington DC-based think tank specialising in energy security. It is this lack of wriggle-room that has brought us to the brink.

In the days when oil producers had more leeway, they could make up for a disruption somewhere in the system by quickly raising production by around 3 million barrels a day, says Nick Butler, head of the Cambridge Centre for Energy Studies, part of the University of Cambridge's Judge Business School. That crucial reserve capacity has now fallen below the daily output of some producers – meaning that if the taps were turned off in any one of a number of unstable oil-supplying nations, such as Nigeria, Iraq, Iran or Angola, the impact would be felt almost immediately.

This has left the oil market so fragile that a few well-placed explosives, an energy-sapping cold winter or an unusually intense hurricane season could send shock waves across the globe. The potential consequences are so serious that governments are drawing up emergency plans to cope should the worst happen. According to one analyst who took part in a simulation of just such a crisis, the ▶

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Protests spurred by the recent rise in the price of oil are a sign of worse to come

"The energy in one barrel of oil is equivalent to that of 5 labourers working non-stop for a year"

situation most experts fear is what they call a "psychological avalanche".

Here's what happens. A small, distant country one day finds it can no longer import enough oil because of a spike in prices or problems with local supply. The news media whip this up into a story suggesting an oil shock is on the way, and the resulting panic buying by the public degenerates into a global grab for oil.

Most industrialised countries keep an emergency reserve as a first line of defence, but in the face of worldwide panic buying this may not be enough. Countries in which the oil runs out face transport meltdown, wreaking havoc with international trade and domestic necessities such as food distribution, emergency services and daily commerce. Without oil everything stops.

The roots of our oil addiction can be traced back to the end of the 19th century, when petroleum began to be pumped from wells across America. It wasn't long before it become obvious what a great transport fuel it could provide. Oil-based fuels paved the way for intensive farming and extensive road networks; they drove the influx of populations into cities, drove growth in shipping and eventually made mass air travel possible. "Oil has shaped our civilisation. Without crude oil you'd have no cars, no shipping, no planes," says Gideon Samid, head of the Innovation Appraisal Group (IAG) at Case Western Reserve University in Ohio.

And it's not just about fuels. A giant chemical industry relies on oil as its feedstock, and without it many of the products we now take for granted would vanish. "You'd see no plastics, no bags, no toys, no cases on TVs, computers or radios. It's absolutely everywhere," says Samid.

"Much of the economic expansion and growth of the human population in the 20th century is directly tied to the availability of large amounts of cheap oil," says Cutler Cleveland, director of the Center for Energy and Environmental Studies at Boston University. "There isn't a single good or service consumed on the planet, except in rural economies, that doesn't have oil embedded in it. Oil is the lifeblood of the global economy."

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Attacks on shipping during the Iran-Iraq war of the 1980s caused worldwide oil shortages

The secret of oil's success is its portability and extraordinarily high energy density. One barrel of oil contains the energy equivalent of 46 US gallons of gasoline; burn it and it will release more than 6 billion joules of heat energy, equivalent to the amount of energy expended by five agricultural labourers working 12-hour days non-stop for a year.

The vast majority of oil is consumed by transport. In the US, that sector accounts for nearly 70 per cent of the 20.7 million barrels the country gets through each day. The chemical industry turns half of the rest into plastics, solvents and pharmaceuticals.

More than half of the world's oil comes from seven countries, the leading supplier being Saudi Arabia, which produces more than 10 million barrels a day. Then come Russia, the US, Iran, China, Mexico and Canada. Twenty years ago, there were 15 oilfields able to supply 1 million barrels a day. Now, there are only four. The largest is the Ghawar field in Saudi Arabia.

The IEA, which advises 27 countries on oil emergencies, requires its members to hold at least 90 days' worth of fuel, which can be pooled and released onto the market if a crisis looms. The system last swung into action in 2005 when hurricane Katrina caused the shutdown of more than 23 per cent of the US's oil production capacity. A few days after Katrina struck, the IEA ordered the release of 2 million barrels a day from reserve stocks for a month, the first time reserves had been released since the Gulf war in 1991.

About half the world's oil is distributed by tankers mainly plying a handful of key routes across the oceans. The rest goes through an extensive network of pipelines that can carry different grades of crude and synthetic compounds, such as lubricants. The bewildering complex of pipelines – extending 90,000 kilometres in the US alone – crosses continents and dips under oceans.

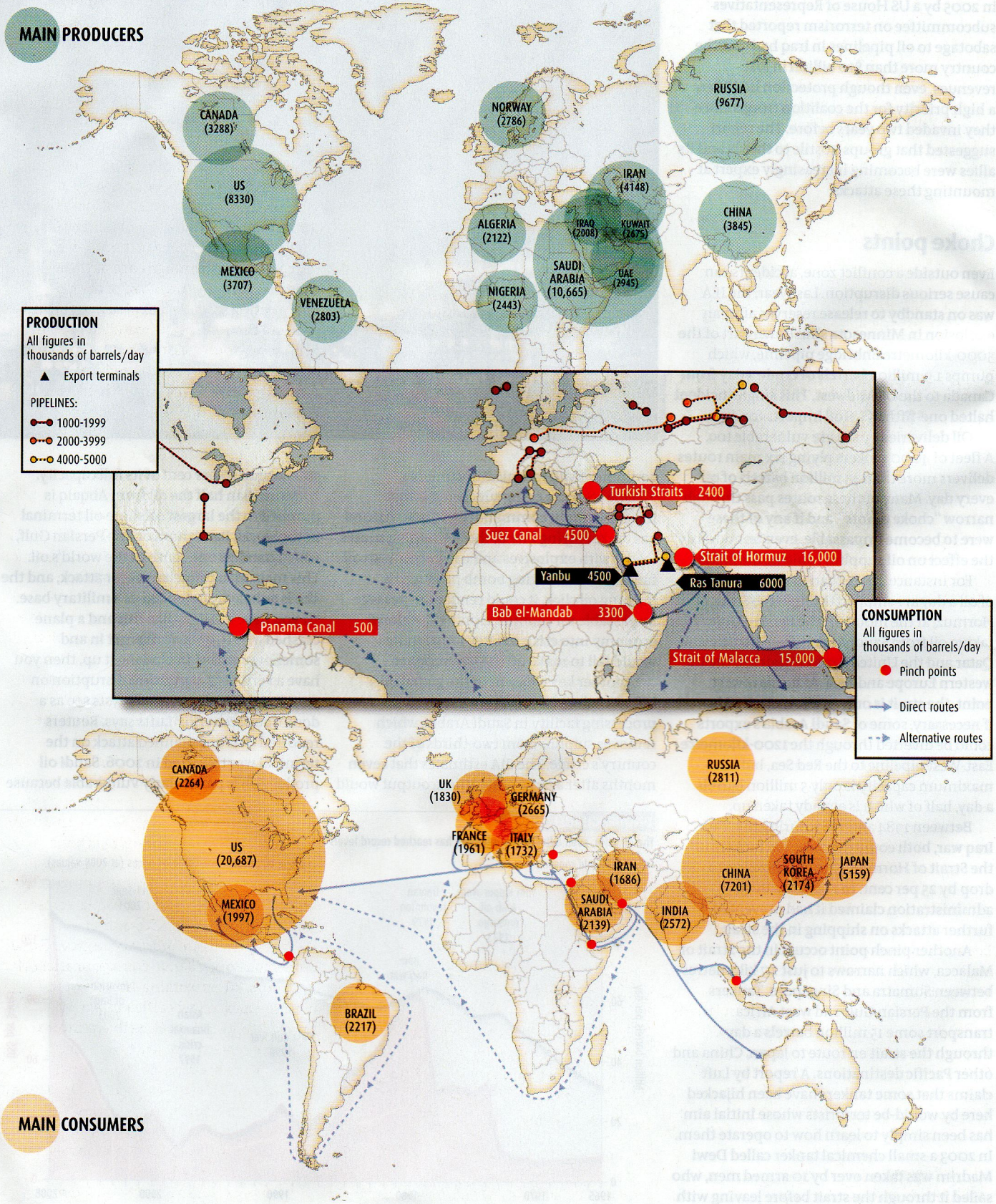
The pipelines are often above ground and vulnerable to accidental damage or attacks by saboteurs. When working, however, they provide an extremely efficient way of transporting oil. A pipeline that pumps a relatively modest 150,000 barrels per day delivers the equivalent of 750 oil tanker truck loads or one delivery every 2 minutes, day and night. Even if a pipeline is damaged, it can usually be quickly repaired. Valves at intervals along the pipe can isolate the leak while the damaged section is replaced.

Disruption can still be costly. A report ▶

DANGER ZONES

A huge proportion of the world's oil supply flows through just a handful of pipelines and shipping lanes. Knocking just one of these out could have dangerous consequences

All figures in thousands of barrels/day



in 2005 by a US House of Representatives subcommittee on terrorism reported that sabotage to oil pipelines in Iraq had cost the country more than $10 billion in lost revenues, even though protection had been a high priority for the coalition troops since they invaded two years before. The report suggested that groups hostile to the US and its allies were becoming increasingly expert at mounting these attacks.

Choke points

Even outside a conflict zone, accidents can cause serious disruption. Last year, the IEA was on standby to release reserves after an explosion in Minnesota shut down part of the 5000-kilometre Enbridge pipeline, which pumps 1.9 million barrels of crude a day from Canada to the US Midwest. This single incident halted one-fifth of US oil imports for days.

Oil deliveries by sea are vulnerable too. A fleet of 4000 tankers plying six main routes delivers more than 43 million barrels of oil every day. Many of these routes pass through narrow "choke points", and if any of these were to become impassable, even temporarily, the effect on oil supplies could be dramatic.

For instance, more than 16 million barrels of oil a day are shipped through the Strait of Hormuz, at the mouth of the Persian Gulf, taking oil from Saudi Arabia, Iran, Iraq, Kuwait, Qatar and the United Arab Emirates to the US, western Europe and Asia. At its narrowest point, the strait is only 33 kilometres wide. If necessary, some of Saudi Arabia's exports could be diverted through the 1200-kilometre East-West pipeline to the Red Sea, but its maximum capacity is only 5 million barrels a day, half of which is already taken up.

Between 1984 and 1987, during the Iran-Iraq war, both countries attacked tankers in the Strait of Hormuz, causing shipping to drop by 25 per cent. In 2003, the Bush administration claimed it had prevented further attacks on shipping in the strait.

Another pinch point occurs in the Strait of Malacca, which narrows to just 2.7 kilometres between Sumatra and Singapore. Tankers from the Persian Gulf and west Africa transport some 15 million barrels a day through the strait en route to Japan, China and other Pacific destinations. A report by Luft claims that some tankers have been hijacked here by would-be terrorists whose initial aim has been simply to learn how to operate them. In 2003 a small chemical tanker called Dewi Madrim was taken over by 10 armed men, who sailed it through the strait before leaving with

BRIAN LAWRENCE/GETTY

equipment and technical documents.

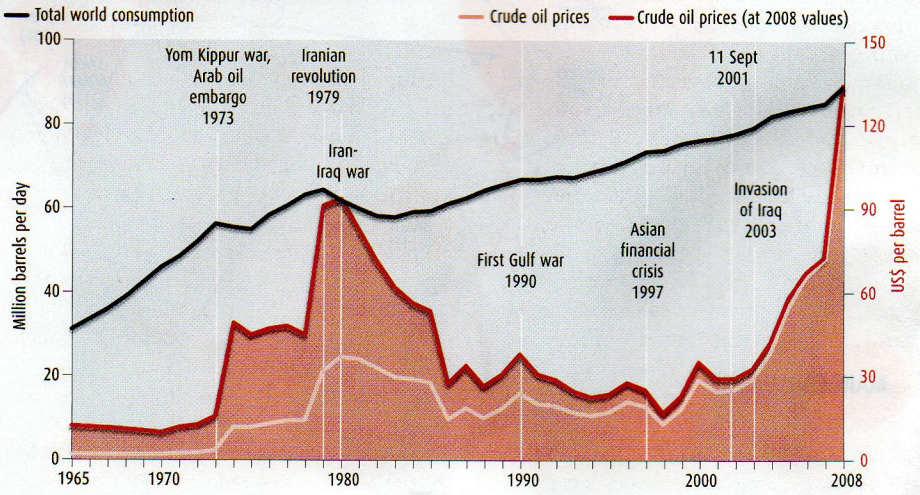
One scenario being suggested is that hijackers might commandeer a liquid natural gas tanker plying one of these shipping routes, load it with explosives and use it to ram an oil tanker. If this floating bomb produced a burning oil slick, it could render the passage impassable for months, tipping the global economy into crisis as alternative routes would fail to make up the lost supplies.

Another key element in the global oil infrastructure is Abqaiq, an enormous processing facility in Saudi Arabia, which removes sulphur from two-thirds of the country's crude. The CIA estimates that seven months after a large-scale attack, output would still be only 40 per cent of its full capacity.

More than half the oil from Abqaiq is pumped to the largest offshore oil terminal in the world, Ras Tanura on the Persian Gulf, which handles one-tenth of the world's oil. This makes it a prime target for attack, and the site is as heavily defended as a military base. "If you have a facility like this and a plane crashed into it, or terrorists get in and somehow succeed in blowing it up, then you have a very, very significant disruption on your hands. That is what analysts see as a doomsday scenario," Lufts says. Reuters reported that one planned attack on the terminal was thwarted in 2006. Saudi oil production is particularly vulnerable because

UNQUENCHABLE THIRST

The oil price, even adjusted for inflation, has reached record levels



A successful attack on a major oil refinery could cause global catastrophe

"It is hardly conceivable that the world could function without oil"

it is concentrated in a few massive production and distribution sites. "If one or two of these facilities goes down, then the entire system goes down," says Luft.

So what would the impact be if oil supplies choked? In 2005, a group of current and former US government and national security officials were asked to address this in a live role-play exercise. Playing the part of the national security adviser was Robert Gates, who the following year became Secretary of Defense. The scenarios that unfolded were developed with officials from the Shell oil company in the Netherlands, a former US presidential counter-terrorism adviser and industry analysts.

The simulation kicked off with an upsurge of political violence in Nigeria, the fifth-largest supplier of oil to the US. In the ensuing turmoil 600,000 barrels of oil production a day were lost from the Niger delta. The violence coincided with the start of a cold winter in the northern hemisphere, which increased demand by 700,000 barrels a day. Together, these events boosted the price of a barrel of oil from $58 to $82; a proportional rise today would push the price beyond $195.

Events began to gather pace when, a month later, the simulation threw in an attack on the Haradh natural-gas processing plant in Saudi Arabia, which forced the country to cut 250,000 barrels per day from its exports – equivalent to the oil consumed every day in Switzerland – to meet domestic needs. Next, news arrived of an attempt to ram a hijacked supertanker into another vessel moored at a jetty at Ras Tanura. This was closely followed by a similar attack at the oil port of Valdez in Alaska, as well as a ground attack which set fuel depots alight. With the world oil shortfall now at 3.4 million barrels per day, the price per barrel had shot up to $123. Against the recent peak price of $139, that rise would take the cost per barrel to $295.

The turmoil leads to an aggressive crackdown on anti-western groups and their sympathisers, which temporarily quells further attacks. Then, six months into the simulation, a terrorist campaign is launched against foreign workers in Saudi Arabia, killing 200 and wounding 250 within 48 hours. Evacuation of foreign workers follows.

Though oil production continues unchecked, this loss of expertise leaves Saudi Arabia unable to meet future demand and with no spare capacity. Fears that this could lead to shortages in the future bring speculators into the market, and the price per barrel rises to $161. At the end of the simulation, global production has fallen by 3.5 million barrels a day, or 4 per cent of world oil supplies. One of the participants, Jim Woolsey, a former head of the CIA, described the scenarios as "relatively mild compared to what is possible", yet this proved enough to almost triple the price of a barrel of crude.

The key conclusion being drawn from this scenario is how reliant the global oil market is on Saudi Arabia's ability to ramp up production on demand. If this extra oil is not available, the price rockets. Saudi Arabia's recent reluctance to increase production and the ensuing price rises in today's real-life oil market amply bear out this prediction.

So where does this leave us at a time when global oil production is approaching the point when it stops growing and starts to decline? Most industry experts, including geoscientists and economists, who were polled by Samid in 2007 said that peak production will occur by 2010. This contrasted with a similar survey conducted two years earlier, in which respondents were split, with many of the economists opting for a later date. "Now, a real consensus is emerging," says Samid.

This tells us that we will have to start making serious attempts to wean ourselves off oil, and fast. It will be no easy task. "It's hardly conceivable that the world could function without oil," says Didier Houssin, director of oil markets and emergency preparedness at the IEA.

Finding a replacement fuel for transport is the biggest challenge. So far all the alternatives have hit the skids. For example, hydrogen, which could potentially replace oil as a green fuel if made using renewable sources of energy, has storage and distribution problems. While biofuels, which could be an easier replacement for fossil fuels, require feedstocks that compete with food crops for water and agricultural land. "To get these alternatives close to what oil can do, you have to invest a lot of money," says Cleveland, something most governments and energy companies have done reluctantly, and at pathetically low levels. "These aren't insurmountable problems, but they suggest the transition has some formidable challenges," he adds. One way or another oil will become more scarce, even more costly and will always have the disadvantage of generating carbon dioxide when it's burned. However hard it may be, the sooner we make the break, the better. ●

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