THE ASSOCIATION FOR THE STUDY OF PEAK OIL

"ASPO"

NEWSLETTER No 21 – SEPTEMBER 2002

ASPO is a network of scientists, affiliated with European institutions and universities, having an interest in determining the date and impact of the peak and decline of the world's production of oil and gas, due to resource constraints.

It presently has members in: Austria, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Sweden and the United Kingdom

Mission:

1. ***To evaluate the world's endowment of oil and gas;***
2. ***To model depletion, taking due account of economics, technology and politics;***
3. ***To raise awareness of the serious consequences for Mankind.***

Newsletters on Websites

This newsletter and past issues can be seen on the LBSystemstechnik website http://www.energiekrise.de (Press the ASPONews icon at the top of the page) and the ASPO website www.isv.uu.se/iwood2002

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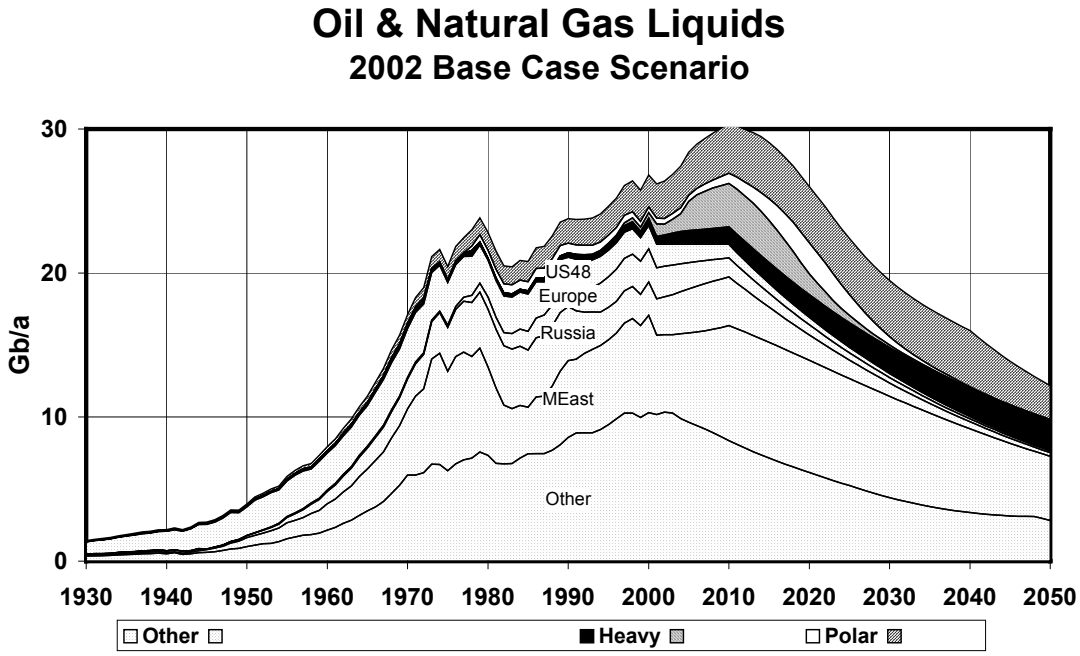
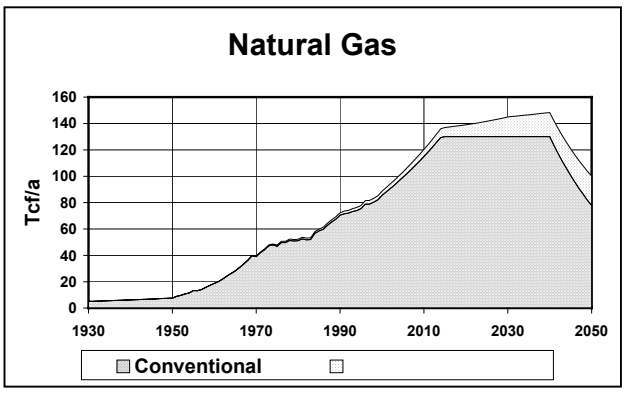
Please note that this e-mail address is being closed to try to escape from the purveyors of Viagra and worse. The new address is aspoone@eircom.net

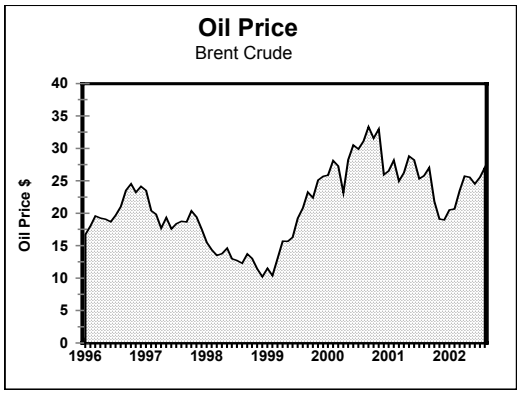
Frontispiece – the general depletion picture



ESTIMATED *CONVENTIONAL OIL* PRODUCED TO 2075 IN			
Known Fields		**New Fields**	**All fields**
Past	Future		Total
873	**884**	**143**	**1900**
In billion barrels (Gb), including condensate from oilfields. Status end 2001			

PRODUCTION RATE FORECAST Mb/d				
	2005	**2010**	**2020**	**2050**
Conventional Oil	**60**	**60**	**46**	**21**
US-48	3.5	2.6	1.4	0.2
Europe	4.9	3.6	1.9	0.3
Russia	8.4	9.2	4.8	0.7
M.East Gulf	17	22	21	12
Other	26	23	17	8
Heavy, bitumen etc	2.8	4	5	6
Deepwater (>500m)	5.6	8	4	0
Polar	1.2	2	6	0
Natural Gas Liquids	8.2	9	11	6
Total	**78**	**83**	**72**	**33**
Base Case Scenario: flat demand for conventional oil due to recession; M.East swing role ending in 2010				





98- Frontispiece

The presentation of the oil depletion plot has been modified yet again on the valuable suggestion of Les Magoon of the USGS. Gas has been removed to a separate plot both to overcome the uncertainties of whether to apply a calorific or value equivalence, and in recognition that it is subject to very different constraints in terms of market, use and transport. The depletion plot is also much more uncertain, being no more than a very generalised scenario. The 5% growth of gas production in the previous version now seems excessive, recognising how much of it is stranded far from market, and has been reduced to 3%, leading to a plateau of 130 Tcf/a from 2015 to 2040. This also reduces the supply of NGL. Non-conventional gas refers primarily to polar gas, coalbed methane and gas from "tight" reservoirs. Hydrates are not considered a realistic source of commercial gas. A plot of oil price has also been added. It would have been reasonable to expect a gradual increase from 1997 when non-Middle East conventional production peaked, but then there was an anomalous fall from an Asian recession and other factors before prices surged in late 2000 as the supply capacity limits were approached. The high prices contributed to the onset of recession, which dampened demand, reducing pressure of price. They seem to be firming again at the present time, possibly due to fears of a US invasion of Iraq with its dire consequences.

99. County Assessment – Saudi Arabia

This month we take a look, with some trepidation, at Saudi Arabia, potentially the world's largest producer of oil, but one very much subject to artificial politically motivated pressures, which are likely to affect future production in many radical ways. Furthermore, the data on present reserves are particularly unreliable.

SAUDI ARABIA

It is thought that Cro-Magnon Man, the most advanced early human subspecies, may have evolved in the Middle East only to exterminate poor old Neanderthal in an early example of genocide. In any event, the region has had a very long history. It is curious that some of the world's main religions, Judaism, Christianity and Islam, all had their roots here. They are monotheistic, believing that the Divinity shows his hand on Earth. The Jews, to their misfortune, are still waiting for their prophet; the Christians had theirs but he was nailed to a cross near Jerusalem; and the Moslems had theirs when Muhammed was born in Mecca in Saudi Arabia around 570 AD.

Whereas the Christians give emphasis to the life hereafter, Moslems believe they please their God in their daily lives, seeing the wrath of God if things go badly. They are guided by rather secular priests using the *koran*, which records the revelations to the Prophet himself. There was a difficulty over the succession, when the Prophet ordained that his mantle should fall to his son-in-law, when the elders preferred the son. This conflict later led to a schism between the Sunni and Shi'ite factions, which still manifests itself throughout the region. Saudi Arabia is Sunni, Iran Shi'ite and Iraq a mixture, which perhaps explains why it needs a strong leader, if it is to remain a single State.

The Moslems were successful, and, from the 7th Century, spread their dominion throughout the Middle East, North Africa and parts of southern Europe, achieving a high level of culture and learning. In the course of this expansion, the power centres shifted from Saudi Arabia to the outposts of empire, especially in Turkey and Egypt, which at different times effectively controlled the homeland, although the desert interior remained under the control of various warlords. One such was Muhammad ibn Saud whose dynasty was founded near what is now Riyadh in the 15th Century

A new religious leader had appeared on the scene in the mid 18th Century in the form of Muhammad ibn Abd al-Wahhab, who founded a fundamentalist sect and supported the Sauds. They were however defeated in warfare with a neighbouring tribe in 1865, being forced to flee temporarily to Kuwait before gradually recovering their lands under a new ibn Saud, a legendary leader of outstanding physical prowess who is said to have sired more than 1000 progeny.

In the epoch leading up to the First World War, most of the Middle East outside Iran belonged to the Ottoman Empire, but enjoyed a degree of autonomy under a rather vague administration. It was a somewhat decadent empire, controlled by its sultan in Istambul, but was propped up to some extent by Britain and France who saw it as a useful buffer to Russian expansion. Its fate was, however, sealed when it decided to side with the Germans on the outbreak of the First World War. That led the British to try to foment an Arab rising under the colourful figure of an Oxford academic, Lawrence of Arabia, who donned Arab kit and headed into the interior on a camel. He sponsored the Grand Sherif of Mecca, who held dominion over the western part of the Peninsula including what is now Palestine, reckoning that he was a direct descendent of the Prophet. A British army, assisted by Arab irregulars led by Faisal, the son of the Grand Sherif, marched north to eventually take Palestine and Syria on the promise of the creation of an Arab Kingdom, once the hostilities were over. But the British reneged on their promises at the Treaty of Versailles following the War. This left the door open for the further conquests by ibn Saud, who eventually proclaimed the Kingdom of Saudi Arabia in 1932. It was duly recognised by Britain in return for guarantees for the territorial integrity of the Gulf sheikhdoms. The Grand Sherif left Mecca, when it fell to the Sauds, and retired to Cyprus, thoughtfully taking the Treasury with him. But, the British did try to make amends. They offered one of his sons, the Kingdom of Jordan, and another, the throne of Iraq in the post-war carve up of the Middle East, when it was eventually achieved, despite the conflicting aims of the British Foreign Office, the British India Administration that had a stake in the Middle East, and the French. The boundaries of the Saudi kingdom remain however a little tenuous, especially with the Yemen.

Having few resources, the desert kingdom relied heavily on the income derived from pilgrims visiting the holy shrines of Mecca and Medina, but during The Great Depression of 1930, the flow of pilgrim dried up, leaving the King strapped for cash. Seeking some new enterprise, he turned to a curious disaffected British colonial administrator, by the name of Harry St John Philby, who had established a Ford dealership in the Kingdom and was none other than the father of the well known British double agent, Kim Philby, of Cold War fame or infamy.

In 1932, the Standard Oil Company of California (now Chevron-Texaco) discovered oil in Bahrain, a few miles off the coast of Saudi Arabia, and Philby arranged for an American mining engineer cum archaeologist, by the name of Karl Twitchell, to investigate the possibilities of Saudi Arabia itself. The report was favourable, and after lengthy negotiations, a concession with California Standard was signed in May 1933 in return of a front end payment of £35 000 in gold bars, duly delivered in seven boxes by a P&O liner from London. Neither side realised the immensity of the deal it had struck.

California Standard later brought in Texaco as a partner to help fund Aramco, the operating company, which after some heroic exploration in the best of pioneering traditions made the first discovery in 1940, before hostilities in the Second World War brought operations to a standstill. By 1943, ibn Saud was partly blind and ailing, and Aramco had become concerned about its rights, seeking the support of the US government. As a result, Exxon and Mobil, two other American companies, were brought in to join Aramco, which they eventually did in flagrant disregard to their commitments under the famous red-line agreement that governed the partners in the Iraq Petroleum Company, to which they were both party.

The American influence in Saudi Arabia was cemented when President Roosevelt met the King in February 1945, presumably promising support for his regime in return for access to his oil.

Ghawar, the world's largest oilfield, had already been tentatively identified before the war, but was confirmed in 1948. It should have assured the four companies and their homeland with an ample supply of oil for many years to come, had not it coincided with the creation of the State of Israel after Zionist terrorists had forced the British to surrender their administration of Palestine. A form of civil war has escalated ever since, now arousing new passions, placing world oil supply in jeopardy.

When ibn Saud died in 1953, the kingdom passed to his son, also named Saud who, proving somewhat inadequate, shared power with his brother, Faisal, before being deposed by the family in 1964. Faisal lasted until 1975 when he was assassinated by a disgruntled prince, to be succeeded by his half-brother Khalid, who was in turn followed by yet another half-brother, Fahd, in 1982. It does not sound a very happy royal family, fraught by tensions between the descendants of the many wives of ibn Saud.

The enormous wealth that flowed to the Sauds from their oil revenues made it a curious state. The people were controlled by a Wahabbi religious police under strict laws, whereby adulterers are stoned and thieves subjected to amputation. The population has grown rapidly to over 20 million with an average age of under 20. It includes large numbers of foreign workers and Palestinian refugees, all of whom depend directly and indirectly on oil revenue. Much of the wealth was spent on arms purchases, contrived by enterprising princes for royal fees, such

that at times there have been more tanks in the desert than drivers. Deposits were also made in US banks, which unbeknownst to the Sauds, became collateral for soaring US domestic debt.

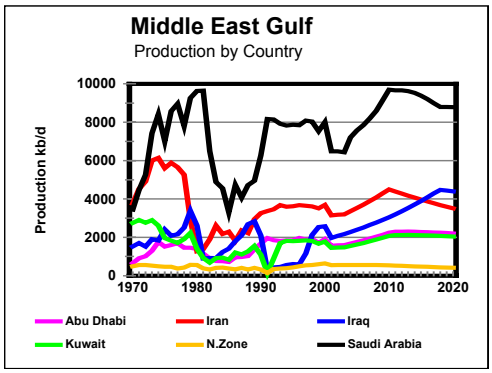
Relations with the United States have not always been easy, despite the long ties. In 1960, the country joined OPEC to try to regulate the world oil price by proration, following the example of the Texas Railroad Commission, when the US faced a similar challenge. In 1973, it participated with other Arab countries in restricting exports to the United States in response to the latter's support for Israel's military expansion. This triggered the First Oil Shock when oil prices increased five-fold, plunging the World in recession. The country expropriated Aramco in 1979, although still maintaining special relations with its previous owners. But it supported the US and its allies in the Gulf War, permitting US military bases to be established in its territory.

King Fahd is now ailing in Switzerland, and the succession is again in dispute. The crown prince, Abdullah, is evidently now de facto ruler, but Fahd's half brothers, Sultan and Nayef, are contenders. The throne threatens to become a fairly hot seat. It is assailed on one side by an increasingly disaffected population, who resent the Saud's US ties, and, on the other, by the US itself, which is now distancing itself, possibly as a prelude to new military operations in the Middle East, which may lead to control of the Saudi oilfields.

In geological terms, Saudi Arabia covers the western margin of the Middle East basin, and possesses two petroleum systems.

The main system depends of Jurassic source rocks and reservoirs in huge gentle structures, endowed with excellent salt seals that prevented the escape of oil. In fact, there is a single prime structural uplift that straddles the country to which oil from the adjoining basins has migrated over time. The world's largest oilfields Ghawar and its offshore extension Saffaniya, together holding some 130 Gb, lie on this uplift. In detail, these fields are made up of about ten compartments, that would have been separate smaller oilfields had the charge of oil not been so great as to cause them to coalesce. Fields outside this prime belt are of about the same size as the individual compartments in the range of 5-10 Gb. As is evident from the discovery plot below, the two super-giant fields of Ghawar and Saffaniya, give a misleading impression of the territory's potential. In geological terms, it is a concentrated habitat with most of its oil in these two super-giant fields, implying in turn that future discovery will deliver much, much less. These two fields are ageing. The southern end of Ghawar has already watered out. A high level of infill drilling is needed to maintain production suggesting that there is in fact very little spare capacity that could be brought on rapidly. Adding significant capacity will take work, much investment and, above all, time.

The second petroleum system depends on deep Silurian source-rocks that have charged patchy and poor reservoirs in the overlying Permo-Carboniferous, yielding mainly gas and condensate, although also some oil on the shallower western extremity of the basin



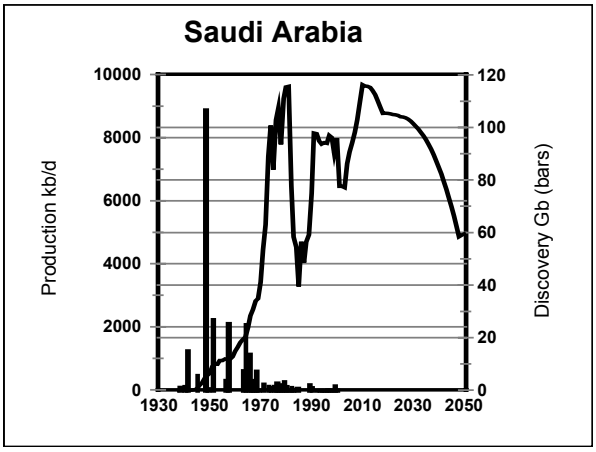
Future production is here modelled on the assumption that the world peak of conventional oil production was in 2000 and that recession will hold down demand, such that production is, on average, flat until 2010. By that date, the five Middle East producers may no longer be able to apply their swing role, offsetting decline elsewhere. Each of the swing countries is assumed to increase production until its depletion midpoint, when production declines at the then depletion rate, with the balance being taken up by Saudi Arabia, as shown in the figure. It is obvious that this is a very uncertain forecast, even ignoring the threat of US military action. Saudi reserves are themselves highly suspect, being a state secret. It is almost sure that the reported estimate of 259 Gb is far too high. A recent paper (O&GJ 17.6.02) suggests as little as 160 Gb is "Proved". It is noteworthy that Saudi Arabia reported 167 Gb in 1989, before it had reason to inflate its reserves to protect itself in the "OPEC quota wars". It may be assumed that these were Proved Reserves in a financial sense, being equivalent to about 75% of the actual amount, which would accordingly be about 220 Gb. Production since then has been 33 Gb, reducing the reserves to 184 Gb, to which may be added about 6 Gb for new discovery, giving a total of 194 Gb.

Consumption is reported by the BP Statistical Review as 1.3 Mb/d, which is surprisingly high when compared for example with 1.6 Mb/d in the United Kingdom. If correct, much must be petrochemical feedstock or exported as product

In conclusion, we may describe Saudi Arabia as an anachronism in the modern world. Its days as a feudal monarchy are almost certainly numbered. Its growing young population, with its large foreign component, who

are exposed to the outside world through the antennas of CNN, are increasingly disaffected and disillusioned. While there may be no particular love lost between them and their Palestinian cousins, the universal condemnation of Israel and its US sponsor may galvanise their emotions. Their own understandable despair and resentment may, accordingly, erupt in violent reaction, putting the world's future oil supply in jeopardy, whatever the composition of the future government of the territory. There is a great deal at stake.

Saudi Arabia		
Rates Mb/d		
Consumption	2001	1.34
Production	2001	6.47
	Forecast 2010	9.69
	Forecast 2020	8.78
Discovery 5-year average (Gb)		0.66
Amounts Gb		
Past Production		91
Reported *Proved Reserves*		259
Estimated Future Production to 2075		
	From Known Fields	194
	From New Fields	14
	Future Total	209
Total Production to 2075		300
Current Depletion Rate		1.1%
Depletion Midpoint Date		2020
Peak Discovery Date		1948
Peak Production Date		2012



Important Postscript

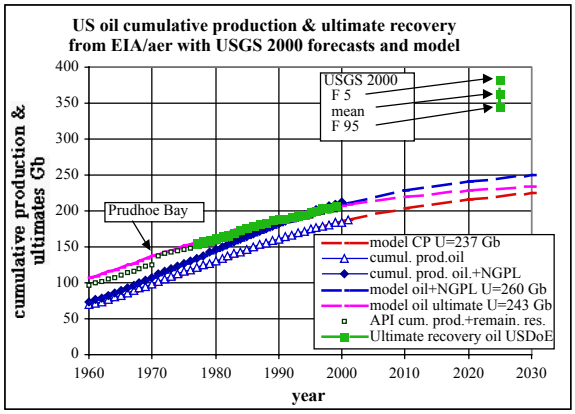
Ms Mowlem, who was until recently a member of Blair's cabinet, has written a compelling article in the Guardian of 5th September 2002, entitled "The Real Goal is the Seizure of the Saudi Oilfields" http://www.guardian.co.uk/Iraq/Story/0,2763,786332,00.html

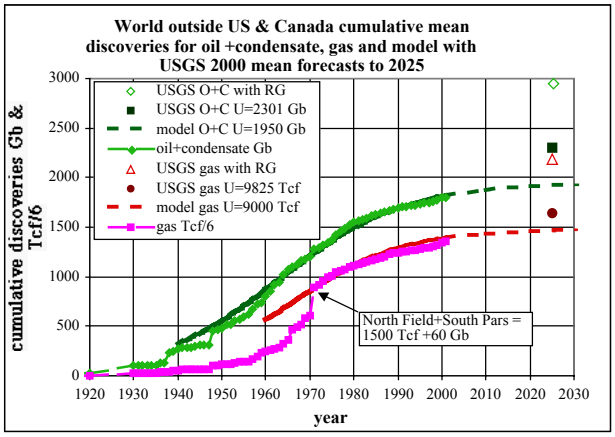
She argues that the US government must realise that an invasion of Iraq would lead to mayhem throughout the Middle East, leading to the fall of governments, including the Sauds. She concludes that this is in fact the object of the exercise

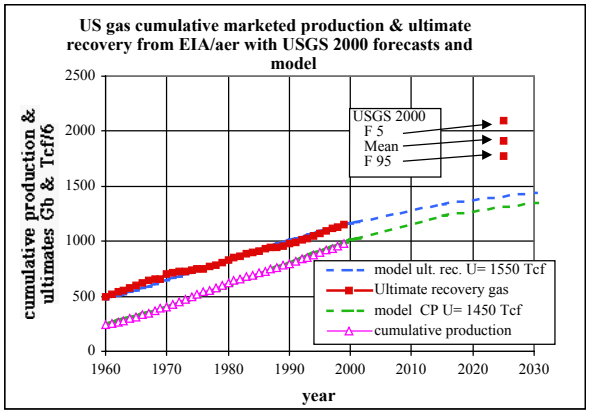
> ***"Under cover of the war on terrorism, the war to secure oil supplies could be waged. The whole affair has nothing to do with a threat from Iraq – there isn't one. It has nothing to do with the war against terrorism or with morality. Saddam Hussein……..is now the distraction for the sleight of hand to protect the West's supply of Oil. And where does this leave the British Government? Are they in on the plan or just part of the smokescreen?"***

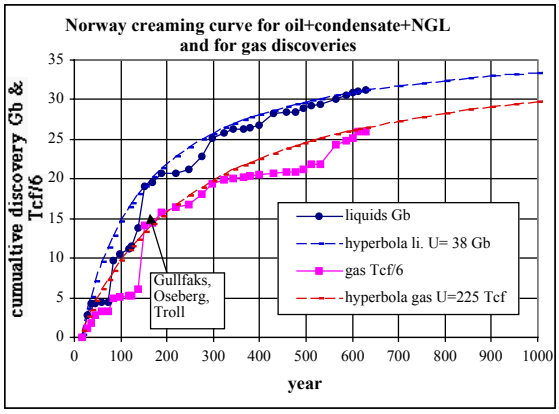
This comes as no particular surprise, as many commentators have reached the same conclusion, speaking of the new Republic of Aramco that would arise from the ashes of Saudi Arabia, but it is remarkable to find it now coming with the authority of a recent British cabinet minister.

100, USGS Study re-examined









Jean Laherrere has re-examined the USGS study finding inconsistencies and confusion even in what is reported from past production and reserves in the USA, quite apart from the flawed forecasts of the future. His graphs tell the story eloquently, showing how the USGS estimates are far out of trend. The Norwegian discovery curve is a firm robust trend pointing to an ultimate discovery of about 34 Gb with a 1000 wildcats, which is very optimistic as it is doubtful if the industry will drill 400 more wildcats to deliver only about 2 Gb. This compares with the NPD estimate of 42 Gb and 48 Gb of the USGS. Norway has had about twenty successive licensing rounds, in each offering the perceived best remaining prospects, which attract drilling commitments. The only chance of these higher estimates being realised is the discovery of an entirely new unforeseen basin in the deepwater or in remote Arctic waters. Pigs might fly.

101. Reserve Reporting

Now that the captains of industry and their accountants are increasingly to be found in handcuffs for exaggerating their assets, we should perhaps ask how the oil industry accounts stack up. After all, Enron, whose management heads the list of scoundrels, was, if not an oil company, at least an energy company.

A major oil company owns refineries, tankers and filling stations but by far the most important of its assets are its reserves of oil and gas, without which the business would soon come to a grinding halt. But these reserves lie far underground where even Arthur Anderson can be excused for uncertain accounting.

But if we were to launch a team of detectives to investigate we might be surprised to find that far from exaggerating their reserves, the oil companies have actually understated them. In fact, when asked about reporting practices, a former managing director of a major British oil company responded:

> *"Naturally I did not think it right to claim all of the reserves that I inherited. That would not be cricket. I wanted to leave as much as possible for my successor"*

So, they emerge as white as driven snow, notwithstanding their well known skills in corrupting governments for prime concessions.

To explain this unexpected conclusion, we have to go back to the early days of the United States where individual landowners owned the oil rights. As a result, the ownership of oilfields was highly fragmented not only by area and by depth, as shallow and deep reservoirs in the same field sometimes had different owners. In early years, there was no shortage Enron-esque tricksters, exaggerating the size of discoveries for promotional purposes, and eventually the Securities & Exchange Commission moved to prevent such fraud by imposing rigorous rules for reserve reporting. In short, the owners of were able to report for financial purposes only the reserves being drained by their current wells, which were termed *Proved.* The reports related only to their particular holding and not to the field as a whole. No one minded if they under-reported the reserves, as the thrust of the rules was to stop fraud by over-reporting.

This long established practice was preserved by the industry as it moved internationally and offshore, most of the companies, being on the US exchanges and subject to SEC rules. They had no reason to complain at the rules, because they found the under-reporting the size of their reserves in this way conferred many benefits. It allowed them to smooth their assets, which would otherwise have fluctuated wildly from occasional discoveries separated by lean years, and it reduced tax in countries operating a depletion allowance, based on *Proved Reserves.* For most purposes, it was a practical and equitable arrangement. The practice of reporting *Reserve to Production Ratio* in terms of years was a derivative, whereby companies could say that their reserves could sustain current production for a given number of years. What they really meant was that the reserves had been *Proved So Far,* it being implicitly assumed that more could be added as needed by exploration and drilling up the fields. In those days it was not an unreasonable assumption in a world perceived to have near limitless resources which could be tapped at will.

We can, accordingly, forgive Professor Adelman, working with such data, for being misled into making his famous pronouncement:

"Minerals are inexhaustible and will never be depleted. A stream of investment creates additions to proved reserves from a very large in-ground inventory. The reserves are constantly being renewed as they are extracted..... How much was in the ground at the start and how much will be left at the end are unknown and irrelevant"

The perception of inexhaustible resources however began to fade when one country after another passed the peaks of discovery and production despite every effort. It is now being replaced by questions of how much is left. Most of the fields are now drilled up to an optimal well-spacing, so little more can be added by new drilling. Advances in technology have also successfully raised the percentage recovered. It follows that *Proved Reserves* have evolved to the point that they cover not just the current wells but the fields as a whole. It means that the companies have less and less left in their under-reported inventories. Some still claim positive reserve replacement, but close inspection shows that it comes more from acquisition than new discovery. It is a perfectly valid financial measurement but does not reflect exploratory success.

This whole business has been greatly confused by the application of probability theory. Naturally all estimates are subject to a degree of uncertainty (or *Probability*) but one range of probability relates to the *Proved Reserves* of current wells, and quite another to what the fields as a whole are expected to deliver. So, it makes little sense to define *Proved Reserves* as having, say, a 95% probability of exceeding the stated value and to say that the field as a whole has a *Mean* probability.

The industry explores the world, drilling many dry holes in the process. The discovery of oil is a transcendental event in terms of adding reserves, and it follows that all the oil ever to be produced from the field in question, under whatever economic and technological conditions as may arise over its life, are logically attributable to the date of the original discovery.

While given a comparatively clean bill of health, oil companies could still improve their public accounts by back-dating their claimed reserves to the discovery date on which they were found. The brokers might recover from the initial shock of discovering that the companies are far from replacing their reserves in any real sense to conclude that what they have left would be an appreciating asset in increasingly short supply.

102 Shell confession

The Sunday Times of August 25th carried a short article entitled *"Oil is running out, says Shell"*, quoting the company as saying "we could be seeing oil shortages by 2025". Whether Shell actually said this in so many words is unsure, but the important point is that the media are beginning to get the message, penetrating the bland words and scenarios.

103 BP shares plunge 6% on falling production

The Times of September 5th carries a revealing article. BP's Chairman, Lord Browne, has evidently enjoyed something like hero status amongst the investment community, which now feels let down when BP announces some technical setbacks, temporarily cutting production. "He does n't walk on water" commented one analyst. It demonstrates the short-term nature of the stockmarket, and why the directors of oil companies have to sing to it. Browne's voice has evidently hit a wrong note. Need we wonder that the word *Depletion* is missing from his hymn sheet?

104 Bloomberg accepts the impact of depletion

The penny has dropped for the well-known New York financial institution, Bloomberg, who now alert their clients to the critical impact of oil depletion and the imminent peak in an excellent, well researched, article
http://www.bloomberg.com/wealth/0902/sep.ft.crude.pdf

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The Newsletter very much welcomes contributions from ASPO members and other readers, who may wish to draw attention to items of interest or the progress of their own research.