THE ASSOCIATION FOR THE STUDY OF PEAK OIL AND GAS

"ASPO"

NEWSLETTER No 37 – DECEMBER 2004

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.

The following countries are represented: Austria, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Missions:

1. To evaluate the world's endowment and definition of oil and gas;

2. To study depletion, taking due account of economics, demand, technology and politics;

3. To raise awareness of the serious consequences for Mankind.

Newsletters: This and past newsletters issues can be seen on the following websites:
http://www.asponews.org
http://www.energiekrise.de (Press the ASPONews icon at the top of the page)
http://www.isv.uu.se/iwood2002
http://www.peakoil.net

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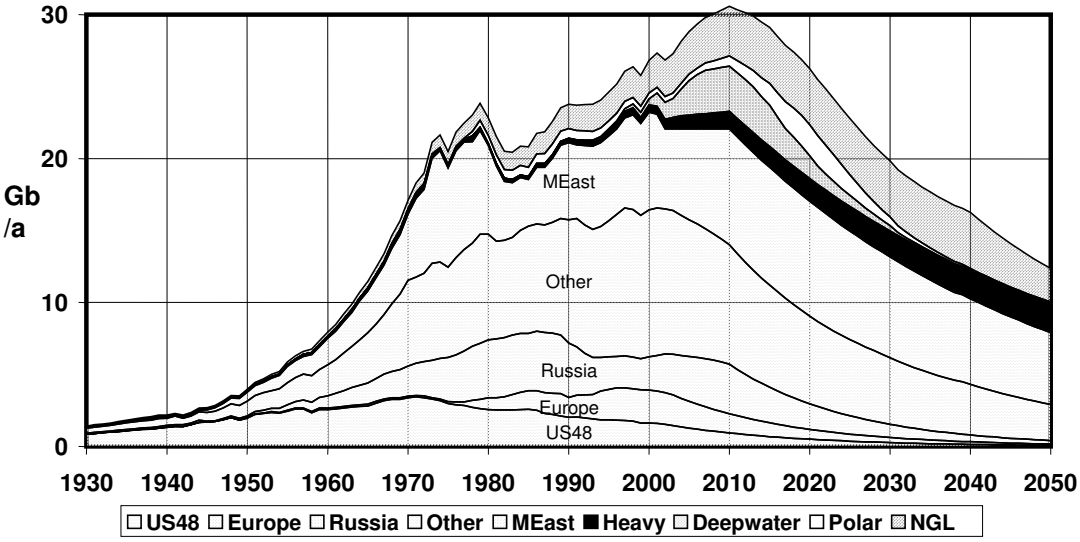
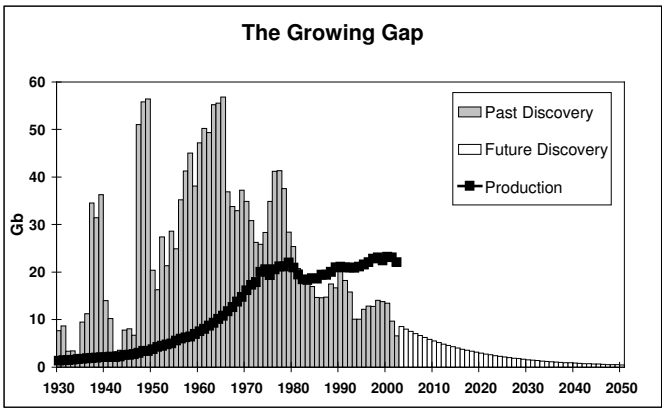
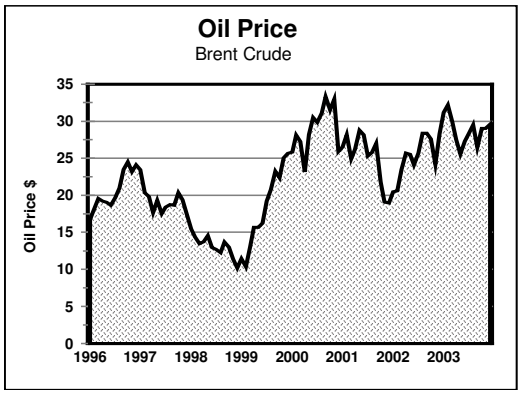
The General Depletion Picture

Oil & Natural Gas Liquids
2003 Base Case Scenario



ESTIMATED PRODUCTION to 2075										
Amount			Gb	Annual Rate - Regular					Mb/d	Peak
Regular Oil					*2005*	*2010*	*2020*	*2050*	*Total*	Date
Past	Future		Total	US-48	3.5	2.6	1.4	0.2	195	1971
Known Fields		New Fields	(to 2075)	Europe	5.1	3.7	1.9	0.3	76	2000
896	871	133	1900	Russia	8.6	9.4	4.9	0.7	200	1987
All Liquids				M.E.Gulf	17	22	22	13	749	2014
986	1714		2700	Other	26	22	17	8	680	2003
Status end 2002		*Estimates rounded*		**World**	60	60	47	22	1900	2000
Base Case Scenario :				Annual Rate - Non-Regular						
Flat demand to 2010 for Regular Oil				Heavy etc	2.8	4	5	6	300	~
from recession.				Deepwater	5.6	8	4	0	60	2012
M.East swing role ends 2010				Polar	1.2	2	6	0	60	2020
Regular Oil includes condensate				Gas Liquid	8.2	9	11	6	400	2027
but excludes liquids from gas fields				**ALL**	78	83	72	33	2700	2010





298 Canadian Tarsands

The following article by John Busby reviews the potential for Canadian Tarsand production, noting the low extraction rate and the low net energy yield

Oilsands Production

Bitumen occurs naturally in the Canadian State of Alberta in huge tarsands (or oilsands), which it is claimed hold some 1600 Gb (gigabarrels) of oil. Although the size of the deposit is huge, the extraction rate is very low, yielding a low net energy contribution and carrying heavy environmental costs. The deposits consist of sands impregnated with bitumen, which are subject to "surface-mineable" or "in-situ" extraction methods.

The **surface-mining** recovery method involves massive excavation, needed to remove the overburden and reach the oilsand, which is then subjected to steam or hot water treatment and centrifuging to separate the bitumen from the sand. The water, sand, fine clays and unseparated bitumen are deposited in tailing ponds. The overburden and coarse sand from the tailing ponds is stockpiled for later reclamation or used to build pond dykes.

The deposits are not homogenous with subtle variations that make a big difference to the extraction viability. So far the maximum overburden thickness that can be removed economically is about 70 metres and only the more favourable sites have been developed.

The **in-situ** recovery method is used where the oilsand occurs below 50 metres of overburden. This requires a technique of slant drilling two boreholes into the deposits, drilling through the overburden, then turning horizontally into the oilsand layer. One borehole allows steam injection from the horizontal section of the borehole into the oilsand to mobilise the bitumen for recovery through a second horizontal borehole below the first, bringing it to the surface. Natural gas is also injected to reduce the density of the bitumen as an aid to recovery through the return borehole. This is known as Steam-assisted Gravity Drainage (SAGD) and is being applied in four new locations. Other in-situ techniques under development are cyclic steam stimulation (CSS), pressure cyclic steam drive (PSCD) and pulse technology and vapour recovery extraction (VAPEX).

The bitumen has then to be diluted for pumping to plants for processing into synthetic crude oil or for direct use as bitumen. The diluent is recovered and recycled, and the bitumen is "coked" or hydrogenated to obtain lower carbon molecules. It is then desulphurised to form a "sweet" crude for normal refining.

The surface-mining method leaves a devastated landscape requiring reclamation. One of the major producers, Syncrude, in its sustainability report for 2002 indicates that of an area of land cleared each year only 16% is being reclaimed, adding 1000 hectares each year to a legacy, which at the end of the project will require considerable energy to restore, when none may be available. The report also shows that of the energy gained in the synthetic crude oil produced, 26% is used in the extraction process in the form of natural gas, coke, diesel, electricity, jet fuel, petrol and propane. If the energy required to restore the unreclaimed land is taken into account, then in the excavation method around one-third of the net-energy in the synthetic crude oil is lost.

The in-situ steam-assisted gravity drainage recovery method also involves an energy loss. The recovery of the bitumen and its upgrading to synthetic crude oil requires an input of natural gas, which is used for steam generation, as uplifting gas to aid flow in the return borehole and for the production of hydrogen for hydro-treatment.

To this must be added further gas for electricity generation, requiring a total of around 30% of the net-energy in the synthetic crude oil, currently supplied in natural gas.

Both the mining and in-situ recovery methods require considerable quantities of water. (Three barrels of water are required to produce one barrel of bitumen.) The occurrence of droughts has required operators to re-use some for process hot water, but water supplies are likely to remain problematic.

Production in 2002 was at the moderate level of 0.303 Gb of bitumen, of which 64% was surface-mined and 46% was in-situ. Fifty-three percent of the bitumen produced was processed into synthetic crude oil, the balance being sold as bitumen for road surfacing and other purposes. The refineries in which the synthetic crude oil is blended with normal feedstock are connected to a network of pipelines serving both Canada and the USA. Crude bitumen is diluted with pentanes for transporting to markets outside Alberta, in which case the diluent is not returned.

The operators have included crude bitumen in their production statistics and in reality only provide around half of the figures claimed as synthetic crude oil which total 0.16 Gb.

Oilsand Reserves

Exxon/Mobil has published a brochure in German called "Oeldorado 2003" in which they provide global and national oil and gas statistics. By adding what they consider to be the contribution of the Canadian oilsands reserves to the global figure they increased their estimate of it from 1027 Gb in 2001 to 1206 Gb in

2002. This followed the raising of the proven crude oil reserves figures in the Oil & Gas Journal in their 2002 report.

Oeldorado 2003 adds 179 Gb to the global oil reserves, which includes the 174 Gb estimated by the Alberta Energy and Utilities Board as recoverable from what they term "in-place" reserves of 1600 Gb. This has ranked Canada second to Saudi Arabia as their reserves have jumped from 4.8 Gb in 2001 to 178 Gb in 2002!

However, the synthetic crude oil produced from this estimated 174 Gb of recoverable bitumen will be limited by the amount of natural gas available. Of the energy in the synthetic crude oil produced 30 % is required in the recovery of the bitumen and for its upgrading. If this energy is obtained solely from natural gas (as it is at present), the recovery of 174 Gb of synthetic crude oil would consume 30% of its energy in natural gas, which is around 8.35 tm^3 (trillion cubic metres).

Canada's natural gas reserves and its production and consumption of the same are inexorably linked with the USA. This is illustrated by the following table:-

2002	Gas reserves tm^3	Production tm^3	Production %	Depletion rate %	Consumption tm^3	Consumption %
USA	5.19	0.5477	75	10.5	0.6675	89
Canada	1.70	0.1835	25	10.8	0.0807	11
Total	6.89	0.7312	100	10.6	0.7482	100

The above shows the fragility of Canada's natural gas supplies, supplying the USA with 65% more than its own consumption. Demand for natural gas in North America is set to rise in line with economic growth, bringing the future of gas supplies sharply into focus.

This is leading to a growing dependence on imported liquid natural gas from projects such as Shell's Sakhalin venture in Eastern Russia. Shell's project involves a pipeline from the gas field to an ice-free harbour, cryogenic liquefaction for transport in special gas tanker ships and off-loading and gasification facilities on the American West coast.

In consequence of this complexity, the delivery costs will raise the price of networked gas when supplemented by liquid natural gas. But of more significance is that as supplies of crude oil decline, natural gas would be better employed in producing liquid fuels directly in gas-to-liquids processes.

The global industry is turning to natural gas for synthesis of petrol, diesel and jet fuel. Indigenous gas production will be supplemented by importing liquid natural gas: to use some of this to extract bitumen from underground and upgrade it to synthetic crude oil for subsequent refining into liquid fuels, rather than convert the gas directly to liquid fuels does not seem to be optimal.

Assuming that 10% of the USA and Canada's remaining natural gas could be earmarked for oilsands synthetic crude oil extraction, i.e., 0.69 tm^3 - only 14.4 Gb of synthetic crude oil could be extracted from the oilsands reserves by its use. For comparison, the USA, Canada and Mexico together consumed 8.6 Gb of crude oil in 2002 - i.e., the recoverable oilsands synthetic crude limited by gas availability would provide only 1 ½ year's crude oil consumption in the North American market.

The way forward may be to use more of the bitumen as a source of heat. Another in-situ recovery method utilises the direct underground combustion of the bitumen. Oxygen or air is injected into the oilsands layer to burn some of the bitumen in order to bring other bitumen to the surface. There would still be the need for hot water for separation from the sand and for hydrogen (from methane) for upgrading to synthetic crude oil. This method is under development.

The upgrading of Canada's reserves by the Oil & Gas Journal and Oeldorado 2003 to rank it second in the world is therefore unwarranted. In any case, if synthetic crude is included in the oil reserves figure, global natural gas proven reserves should be reduced by 8.35 tm^3 (from 155.78 tm^3 to 147.43 tm^3) to take into account the energy loss associated with the production of 174 Gb of synthetic crude oil.

299. Iraq Reserves

The New York Times of November 30th carried a revealing article by Jeff Gerth about Iraq's reserves. It reports that the Iraqis were injecting as much as 400 kb/d of oil into the giant Kirkuk Field during the embargo. One quoted export said that he had never encountered such a practice in his lengthy career in the industry. Indeed why would anyone inject oil to recover oil? The answer presumably is that oil exports were embargoed but they needed the gas for domestic use. From a reservoir standpoint this is very bad news as the expanding gas cap is normally a useful drive mechanism. To restore such a field is a reservoir engineering nightmare, especially if the records have been destroyed and the experienced people killed. The report says that it may now be possible to recover only 15% to 25% of the oil in place. Meanwhile the occupying forces are concentrating on

trying to repair the surface facilities being hesitant to address the subsurface for fear, as the New York Times no less admits, the objective of the invasion should become self-evident. It looks as if a serious downward revision of Iraq's future production potential is called for. The published Reserve estimate of 112.5 Gb looks increasingly unreliable. Perhaps it makes more sense to revert to something around 50 Gb, closer to what was reported prior to the anomalous jump to 100 Gb in 1988, when the OPEC countries were vying with each other for quota based on reported reserves.

see www.nytimes.com/adx/bin/adx_click.htm (*Reference furnished by Kellia Ramares*)

300. The Stockbrokers View

It is instructive to read what the investment community thinks of the major companies. One investment house has reviewed the production peak of the major companies. Unfortunately, they report in terms of oil equivalent, which confuses the issue of depletion. But even so, show a peak of production from existing fields for ExxonMobil in 2008, with that relying on deepwater oil in Nigeria and Angola and gas from Qatar, various Asian fields and Arctic gas from North America and Siberia. Removing the gas and the deepwater, it appears that the company is already past peak so far as *Regular Oil* is concerned. The report mentions declines of 6% in the US-48 and 3-4% in the North Sea.

The report discusses possible developments in the 2007-2010 period for the three major companies, identifying production from the following sources: Deepwater Gulf of Mexico, Angola, Nigeria, LNG, Piped Gas, Tarsands, Russian Oil and Gas, and Other. Re-stated, the key elements by percent seem to be approximately as in the following table. Shell evidently has the most diversified portfolio of *Regular Oil* with BP being heavily dependent on its Russian holdings.

Reading between the lines, it confirms that they have passed peak. Who would face the risks and the technical challenges of producing oil in deepwater or the political risks of Russia if there were anywhere else available. BP has accepted the Russian risk and Exxon was negotiating the Yukos, which the Russian government now seems to seek to preserve from foreign hands, as indeed it should if it had the national interest at heart.

In general, it is at first sight remarkable to see the facile and confused information on which the investment community supposedly relies. Would the investor not rather have a clear statement of precisely how much the company has found over the past few years. In reality, of course, these published investment reports are simply cover. The banks and their key clients take prior positions and the published reports are used to justify the movement of large quantities of institutional money into the selected issues. Their values rise as a consequence delivering profit to the privileged, before they move on the next flavour of the month. That is how the actual system works, which explains why the public information is presented in such an obscure and convoluted form. It is imagery not substantive investment advice, but even so, some useful insight slips through to those willing to dig for it.

	Deepwater	**Regular Oil**	
		Russia	**Other**
Exxon Mobil	36%	8%	8%
BP	16%	44%	0%
Shell	30%	7%	32%

301 New Book links Oil Depletion with the Future of Mankind

Many see oil depletion as a kind of doomsday message heralding the end of the modern world, but Stephen Hamilton-Bergin has written a valuable new book that takes an optimistic line that a better world will rise out of the ashes. This book is far from a scientific diatribe, and may not have it all exactly right, but it catches the essential points in a wide ranging analysis, addressing the condition of Man and his future. In this respect, it is a much-needed book because there is no point in worrying about depletion unless its full meaning can be appreciated as a framework for possible solutions. The author thinks that some kind of crisis is almost to be welcomed to dispose of worthless government and kleptocratic management, leading to some form of a new better life for the survivors. He does not underestimate the difficulties or mince his words.

The essence of the book is summed up by its closing lines.

> Creation has already planned to make everything slow down by slowly and inexorably withdrawing the hydrocarbon energy which was responsible for everything speeding up in the first place. In other words we are going to be forced to slowdown whether we like it or not.

Do we have the collective intelligence to slow down just ahead of the hydrocarbon depletion timetable which nature has put in place or are we simply too selfish and too self absorbed in our material pursuits to notice that we are on the path to self-destruction.

Thank you for your patience. I hope we may find the courage to walk together. The human world will either unite to celebrate its mutual origins or divide and die.

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It is entitled No19 Bus: The Truth about the War and Oil - The Coming Global Energy Crisis ISBN 0-9545318-1-7 and may be obtained from www.no19bus.org.uk or +44 14 4447 1122

302. Country assessment – Trinidad

Trinidad and Tobago is a republic comprising two islands off the east coast of Venezuela. It covers 5000 km^2 and supports a population of almost 1.4 million people. The population density is 262/ km^2, and has almost doubled since 1960, making them fairly crowded islands. The bulk of the population is equally of African and Indian origin, being the descendants of respectively slaves from Africa and indentured labour brought in from India to work the sugar estates after the abolition of slavery. The remaining 20% are of mixed Spanish, French, Portuguese, English, Chinese and Amerindian descent

TRINIDAD		*Regular Oil*
Population M		1.4
Rates Mb/d		
Consumption	2002	0.01
per person b/a		3.9
Production	2002	0.13
	Forecast 2010	0.09
	Forecast 2020	.007
Discovery 5-yr average Gb		0.01
Amounts Gb		
Past Production		3.2
Reported *Proved Reserves**		0.72
Future Production - total		1.3
From Known Fields		1.1
From New Fields		0.2
Past and Future Production		4.5
Current Depletion Rate		3.4%
Depletion Midpoint Date		1983
Peak Discovery Date		1969
Peak Production Date		1978

*Oil & Gas Journal

Trinidad is cut by the Northern and the Central Ranges, rising to respectively 900 and 300m, while in the south lie various low hills, sometimes termed the southern ranges. The intervening lowlands are partly swampy, giving the Caroni and Ortoire Swamps. The natural vegetation is tropical rain forest, but most of the lowlands are under cultivation, with sugar cane being a substantial cash crop.

Christopher Columbus made landfall on Trinidad on his Third Voyage in 1498, giving it its name after three prominent hills in the southeast corner of the island, which was at the time inhabited by a small number of Arawak Indians. It was later visited by Sir Walter Raleigh in 1959, who came upon the so–called Pitch Lake, an oil seepage, from which he caulked his ships. It was a Spanish territory for 300 years until the French took it in 1781 to be in turn defeated by a British naval expedition in 1779. It remained a happy British colony until 1956 when a degree of autonomy was imposed prior to full independence in 1962. Independence brought a degree of racial conflict, where none had existed hitherto, culminating in a failed coup by Muslim Fundamentalists in 1990. Renewed security fears were expressed in December 2002 in connection with the Afghan and Iraq wars

In geological terms, Trinidad forms an extension of the oil rich East Venezuelan basin, being in turn flanked by a continental shelf that extends southwards along the margin of South America. The Northern Range is a direct extension of the Andean Coast Range of Venezuela, being composed of low-grade Cretaceous and Jurassic metamorphic rocks. To the north lie structures associated with the Antillean Island arc. A major transcurrent fault, known as the El Pilar Fault, marks the southern boundary of the Northern Range, before extending offshore into the Atlantic. Another wrench fault, the Los Bajos Fault, cuts obliquely across the southern part of the island, being partly responsible for oil accumulations. The main oil-bearing region lies to the south of the Central Range including offshore extensions both eastward into the Atlantic and westward into the Gulf of Paria, which separates Trinidad from Venezuela. The principal source rock in the Caribbean region was a unique deposit of organic rich clay laid down under conditions of global warming about 90 million years ago in the mid-Cretaceous. It crops out in parts of the Central Range of Trinidad, and is probably the main source of oil in the basin to the south. There may however be additional sources for both oil and gas in the thick sequence of Tertiary sediments that overlie it, especially in the Atlantic offshore in what constitutes the palaeo-delta of the Orinoco River.

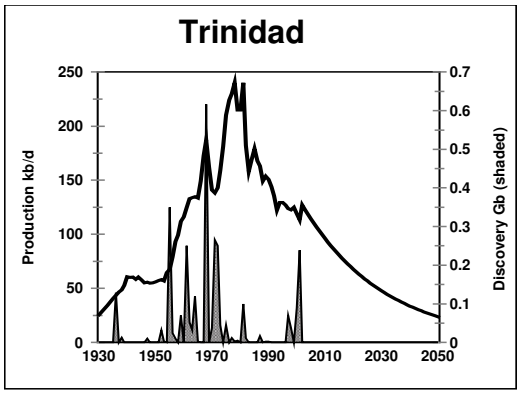
The geology of the southern basin is exceedingly complex. The Tertiary sequence is made up of a great thickness of deformed, monotonous clays, with intervening and overlying sands, some being of turbiditic origin. Trinidad pioneered the use of micro-palaeontology to help unravel its geology in order to identify prospects for oil. Microscopic fossils were recovered from drill cuttings and surface samples in order to establish a sophisticated classification of the strata, which in turn allowed geologists to identify and map their configuration and hence the location of prospects.

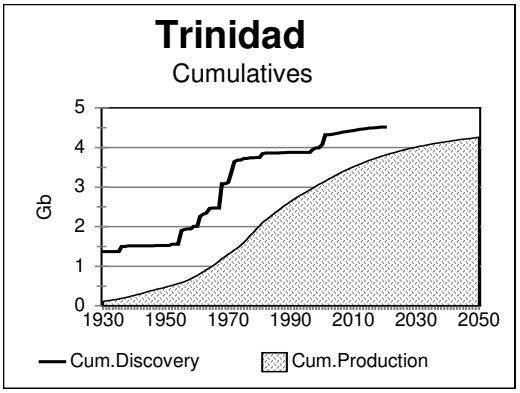
A peculiar feature of Trinidad is the presence of so-called mud-volanoes, forming mounds of mud brought to the surface by gas seepages, which occasionally catch fire.

Trinidad has had a long oil history, starting with the West Indies Petroleum Company, which drilled two shallow wells in 1866, while another company dedicated itself to the distillation of tar from the Pitch Lake in 1867. The first truly commercial well was drilled in 1907 followed by the discovery of the first major field, Forest Reserve in 1914, with some 320 Mb. That prompted a more intensive search by several British companies, which was rewarded with a number of small to modest fields. Shell, BP, and Trinidad Leaseholds, itself being later sold to Texaco in 1956, became the dominant onshore operators. The latter ran a major refinery at Pointe-a-Pierre, which for a period refined Middle East in addition to local oil for export to US and European markets. Trinidad had been in fact a major source of fuel for the United Kingdom during Second World War, supplying much of the high-octane fuel on which the Battle of Britain was fought. The sale of Trinidad Leaseholds to Texaco was not exactly welcomed by the British government in strategic terms, but it acquiesced to the blandishments of the dollar.

A second cycle of exploration opened offshore in the 1950s leading to the discovery of the giant Soldado Field with 600 Mb in 1956 in the shallow, calm waters of the Gulf of Paria. A third cycle followed in 1961 when Amoco (now BP) secured rights to the Atlantic offshore (later termed the Columbus Basin) bringing in a series of major oil and gas finds, starting in 1967. A somewhat surprise fourth cycle may be opening with the discovery of about 2.4 Tcf of gas-condensate in an entirely new province to the northwest of the island near the Venezuelan median line. It remains to be seen if any deepwater potential will be identified after the failure of the six deepwater wildcats drilled so far. One proved to be the most expensive well ever drilled in Trinidad. That may depend on whether the Cretaceous source rocks extend into the area, which seems rather doubtful. A state company, Petrotrin, has taken an active role in exploration and refining, and British Gas and BHP are relative latecomers with a strong position in gas.

Some 325 wildcats have been drilled in Trinidad finding a total of about 4.5 Gb (billion barrels) of oil, of which 3.2 Gb have been produced. It is now a mature province so the scope for future oil discovery seems limited to about 200 Mb, excepting any deepwater finds that may be made. The peak of production was in 1978, almost ten years after the discovery peak, and five years before the midpoint of depletion. About 40 Tcf (trillion cu. ft.) of gas have been discovered, mainly in the Columbus Basin, of which about 30 Tcf remain. The gas is locally processed into synthetic agricultural nutrients, and is exported as LNG to the United States. Gas production has almost doubled over the past ten years to 520 Gcf a year, making it the largest source of US imports. Plans have been announced to increase exports with new facilities to 1.3 Tcf a year. Exports could be maintained at that level for over twenty years, making Trinidad a prosperous place, with the pressures and tensions that that may bring. Plans for a pipeline to Miami supplying the other West Indian islands along the way are under consideration.





303. Depletion hits the headlines

George Monbiot has written an excellent full page article in The Guardian, entitled *The Bottom of the Barrel*, subtitled *The world is running out of oil – so why do politicians refuse to talk about it?*

It is a very good question, but they won't have that luxury much longer.

http://www.monbiot.com/dsp_article.cfm?article_id=625

304 China sells US bonds to buy oil

A report by THE FAR EASTERN ECONOMIC REVIEW points to a fundamental shift in Chinese policy as it becomes a growing net importer in the face of depletion. Tanker rates for cargoes to China are also soaring. China's imports have almost doubled over the past two years to stand at about 2 Mb/d, compared with indigenous production of 3.4 Mb/d. Production is expected to fall to about 2.4 Mb/d by 2010 from depletion. Thus, with even flat demand, imports are set to increase from 22% to 55% of consumption. About half of current imports come from the Middle East.

These simple statistics tell us that the new Chinese "economic miracle" is not going to last. In their disappointment, they may look for someone to step into Chairman Mao's footsteps for the long walk home to the paddy fields, albeit in Gucci slippers.

China Diverts Dollars To Buy Oil

Although still intervening heavily in the foreign-exchange market, in the last few months China has radically scaled back its purchases of United States bonds. In September, Chinese institutions were actually net sellers of U.S. government and agency debt by $2.8 billion, even though foreign reserves rose by $19 billion. Now, economists and market strategists are beginning to wonder what Beijing is doing with all the dollars it is buying. Chinese state media provided a partial answer in early December, reporting that Beijing plans to build up a 90-day, 50-million-tonne strategic oil reserve. At current crude prices of around $30 a barrel, that will cost China $10 billion. Bankers and brokers in Hong Kong predict further large purchases of strategic materials, together with the possible acquisition of equity stakes in overseas suppliers over the coming year. If pursued, China's diversification away from U.S. government bonds will be bad news for Washington, which has relied heavily on China's debt purchases to fund its fiscal and current-account deficits. In Asia, some economists even say Washington had it coming, suggesting that the switch is subtle retaliation for current U.S. trade pressures on Beijing. *(Reference furnished by J.N.von Glahn)*

305 Another Oil Shale venture fails

Southern Pacific, a Company attempting to develop oil shales in Queensland, Australia, has failed. Although the estimated size of the deposit is in excess of 26 Gb, the company, like many others before it, has failed to overcome the technical problems of viable extraction.

http://www.theage.com.au/articles/2003/12/02/1070351580970.html

(Reference furnished by Jean Laherrère)

306 New Zealand wakes up to Depletion

The following paper reports on a conference in New Zealand.

OIL AND GAS WELLS EMPTYING

Quoting evidence from the Hubbert School for Petroleum Studies in Colorado and other authorities, the Moderator, Mr. Bruce Thomson, explained that there had been a global peak in oil discoveries in 1960, and that for the past forty years, the amount of oil discovered has consistently declined despite all technological innovations.

"At present the world consumes four barrels of oil for each barrel discovered. Most of it's from oil fields discovered decades ago. Within this decade, even those fields will start declining forever, beginning fierce international competition for the dwindling oil, and very high prices," said Mr. Thomson.

There were comparisons with the oil shocks of 1973 and 1979, but this time there would not be a restoration of supply. In those crises, the shortages were political action, but this time the oil wells were in final, permanent decline. Another speaker, Robert Atack, who runs a website www.OilCrash.com, reported that natural gas was also about to decline in North America according to Matthew Simons, who is a prominent investment banker and advisor to George W. Bush. New Zealand's Maui gas is expected to be depleted in about 2007 according to the Natural Gas Holdings Corporation (NGC).

PREPARATIONS

At the meeting Mr. Pepperell conferred with the group about best preparatory measures. It was agreed that the energy decline problem needed exposure when transport and roading plans were proposed, because scarcity and high price of fuels would reduce traffic. "Asphalt is created out of crude oil too", said Mr. Pepperell. "It is already becoming a problem because of increasing cost."

Localizing business activities would help protect companies from insupportable costs for fuels. Because the problem was global, imported goods would become much more expensive than local alternatives.

Agriculture would be affected because soil productivity was currently magnified several times by fertilizers created out of natural gas.

In general it was agreed that the media had not covered the issue much, despite its serious implications to the public. This was changing though, as news emerged of the Maui gas field expiring, and the USA's motives for invading Afghanistan and Iraq were questioned internationally.

The group has a website summarizing their views, at http://www.geocities.com/RunningOnEmptyNZ

307. Successful Meeting on Peak Oil in Copenhagen

The Danish Board of Technology and the Society of Danish Engineers held a successful conference on December 10th with the programme as outlined in Item 295 in the last Newsletter. Four presentations stood out as particularly significant. The first was by Francis Harper of BP who gave a lucid and even-handed explanation of so-called "Reserve Growth" expecting its impact to be much reduced in the future. The other was by Don Gautier of the USGS, who drew attention to Hubbert's support for the somewhat far-out Technocracy Movement in the 1930s, showing a cartoon of his expulsion from a university. This appeared to be a thinly veiled attempt to discredit Hubbert, who was one of the pioneer analysts of the peak and decline of finite resources, and a renowned scientist in other fields too. Gautier furthermore gave emphasis to the depletion profile of the Midway Sunset Field in California, which has not followed the normal depletion profile for the simple reason that it is a heavy oil field.

It is evident that the USGS has an agenda beyond the scientific analysis of the depletion of world oil. It is now turning its attention to a new study of the Arctic. This should provide ample scope for an assessment of huge oil reserves under an extreme range of subjective probability, capable, after 50 000 Monte Carlo iterations, of delivering a high *Mean* value.

More encouraging were two wise, thoughtful and penetrating political presentations by Jorgen Henningsen, Principal Adviser to the Directorate of Energy and Transport of the European Union, and Svend Auken, former Minister of Energy and the Environment in Denmark.

308. OPEC considers the Euro

The Secretary General of OPEC announced that the organisation contemplates trading oil in euros or a basket of currencies, also hinting that target price band of $22-28 might be lifted. These moves in part reflect the devaluation of the dollar, adversely affecting the net revenue to the producing countries. The next Secretary General, taking over on January 1st, will be the Energy Minister of Indonesia who will no doubt have many good reasons for supporting this move

(Reuters Report of 8th December furnished by Laurence Puchalski

309 Polar Confession

The Depletion Model given at the beginning of the Newsletter shows polar oil having an endowment of about 50 Gb with production to peak around 2020 at 2 Mb/d. No particular credence should be attached to this aspect of the model. Evidence to date suggests that the Arctic regions are primarily gas-prone due to vertical movements of the crust under fluctuating ice-caps in the geological past. The Arctic Circle is naturally an arbitrary cut-off at 66.5 degrees North but is as good a line as any other. So far, oil has been found, just north of the Circle, in and around Prudhoe Bay in Alaska, in the Beaufort Sea off Canada, at the northern end of the West Siberian Basin and locally in adjoining waters. At a guess, not much more than about 15 Gb have been found, so to attribute a ultimate total of 50 Gb is by all means an optimistic interpretation of future discovery. The reason for having this high number is largely diplomatic to help close the gap with what seem excessive Russian claims. It seemed better to shunt some of them into the unknown Arctic rather than dismiss them out of hand – hence the confession. It will probably be expedient to let the 2020 peak slide forward year by year until more definite information to the contrary is available. The Antarctic is perceived to be essentially non-prospective due to unsatisfactory source rocks, and is in any case closed to exploration by agreement. It remains true, however, that these are comparatively unknown areas, which is another good reason for distinguishing them from *Regular Oil*.

310 Gas Prices surge in the United States

The New York Times of December 13th reports that gas prices have risen 50% in the last few weeks to $7.22 / M Btu, causing grave concern to the chemicals industry, whose spokesman is tellingly reported to have commented.

"If what is happening with natural gas would happen with crude oil, we'd have declared war on OPEC by now."

The article adds "Gas drilling has increased, mainly in the Rockies and in Texas, but much of it has come from fast-depleting wells. Imports of natural gas from Canada, meanwhile, have grown less reliable than in past years as demand for the fuel has also increased in that nation". *(Reference furnished by Jeff Newton)*

311. Meaning of Proved Reserves

The term *Proved Reserves* has probably caused more confusion in relation to the study of Depletion than any other aspect of the matter. It is commonly defined as:

"those quantities that geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions"

Another term with a similar meaning is *Booked Reserves* for the amounts which companies decide to include in their financial accounts, under whatever book-keeping practices they operate. Some analysts draw attention to the words "reasonable certainty" to assert that it is a matter of *Probability.* That has led to the notion of *subjective probability* such that a certain estimate is said to have a percentage probability rank, with *Proved Reserves* having, say, a 90% value.

That it turn prompts the question: Probability of What? Probability that the amounts are there to be extracted? or there to be extracted with varying degrees of profit expectation? or to be actually extracted in the real world, by whom? and when? There are shades of meaning.

The comments of Francis Harper at the Copenhagen Conference prompted the thought that in fact it is more a question of money than probability. He referred to the Prudhoe Bay Field in Alaska, commenting that producing the tail end of a field involves investing a great deal of money on infill wells, workovers, maintenance and other operations. In 1977, BP, the operator, evidently estimated that it was capable of producing about 12.5 Gb, as now confirmed by the decline analysis, but reported 9 Gb as *Proved*. This possibly meant that the Company was not sure at the time that it would be willing to make the tail-end investments. It might have better places to put its money; the environmentalist might have marched; the eskimos revolted, the taxes gone up, the pipeline rusted, or the oil price collapsed. All sorts of things might have happened to cause the Company to walk away from the tail end. So, the term *Proved* in fact meant a reasonable estimate of the minimum the Company actually planned and expected to extract in the real world. In this sense, it sounds an eminently sound estimate to report for financial purposes, being largely an expression of confidence. In fact, it may indeed partly reflect or explain the flat-earth economists' view that reserves are simply a matter of investment with geological factors being substantially irrelevant.

It seems a great mistake to equate this confidence factor with the physical amount of recoverable oil in the reservoir or the probability ranking of the diverse physical factors controlling recovery. It is a still greater mistake to imagine that, when BP increased its estimate to its current value, it reflected any particular technological development. It simply meant that it now had confidence that it would actually produce the tail end. This perhaps explains the differences in reporting practices in different environments. Offshore, the companies face massive front-end investments in platforms, which no doubt they design on a very high confidence factor, and report correspondingly conservative *Proved Reserves* to justify the investment. Onshore in an established province like Texas, *Proved Reserves* were added on a well-by-well basis as the fields were drilled up.

Particular fields may be beneficiaries of technological progress, in some cases providing a higher than anticipated recovery, but by and large it seems that the growth in *Proved Reserves* is simply an expression of growing investment confidence. As fields get smaller and located in ever more hostile places, the companies will have to take a deep breath to begin with facing the full risks up front, leaving less room for subsequent upward revisions, especially if the life of the field is short. Perhaps it explains why exploration drilling is declining and why the companies embrace each other through merger rather than face the cold wind alone.

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