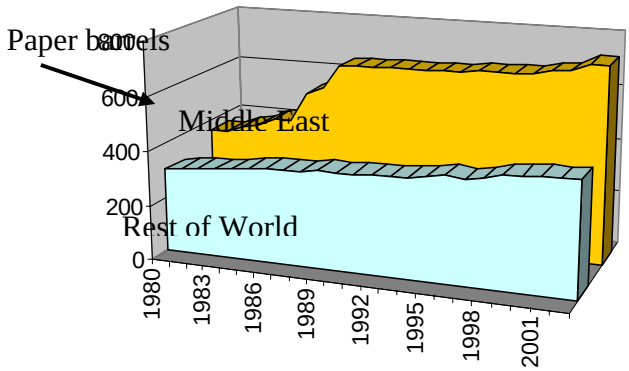
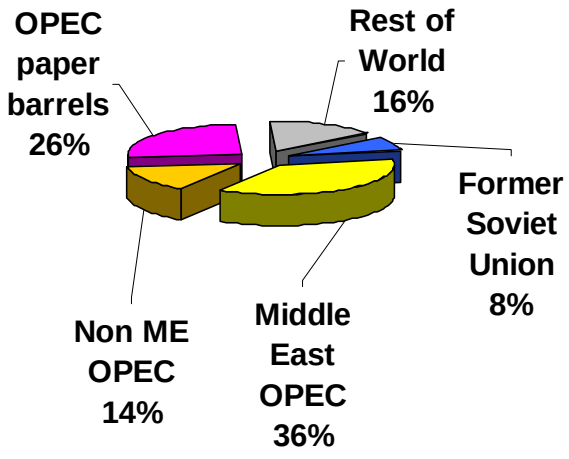
Next intelligence failure

300 billion barrels OPEC oil missing

Reserve history (Gb)



BP's end 2003 reserves: 1147 Gb



Opec's spurious reserve additions in the 1980s now a serious issue as the world starts to look for its remaining oil reserves

Updated: includes WEO 2004

Prepared by: Matt Mushalik **December 2004**

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List of Contents

Appendices:

Introduction

The UK Government has recently asked for more "transparency" in relation to OPEC's top secret remaining oil reserves. In plain English: the world is flying blind. Prof. Goodstein from California reminded us in Tony Jones' ABC TV Lateline programme on 22/11/2004 that not only Shell and other companies had to reclassify their reserves downwards but that countries, who own 90% of the oil, have also overstated their reserves. Matthew Simmons, a former participant in Dick Cheney's 2001 Energy Task Force demands immediate 3rd party inspections of OPEC oil fields and related records, which would reveal the magnitude and the proximity of the problem.

Summary

According to a series of oil depletion reports and articles published in the course of 2004, 300 billion + barrels of OPEC oil reserves seem to be missing out of a world total of 1147 bn barrels (BP's Statistical Review of World Energy 2004). There is mounting evidence that s**ome OPEC countries are reporting total oil reserves ever discovered, including past production, instead of remaining reserves**.

Therefore, BP's quoted future reserves contain oil already consumed. If this turns out to be the case, the world is facing an oil crisis the consequences of which we have not understood yet.

BP relies on oil reserve reports from many governments

BP collects data from various oil producing countries without validating them. It therefore relies on the truthfulness of reserve data reported e.g. by governments. A fine print at the bottom of BP's proved reserve table adds an important, but often overseen qualification: "The estimates in this table have been compiled using a combination of primary official sources, third party data from the OPEC Secretariat, World Oil, Oil & Gas Journal, and an independent estimate of Russian reserves based on information in the public domain. The reserves figures shown do not necessarily meet the United States Securities and Exchange Commission definitions and guidelines for determining proved reserves nor necessarily represent BP's view of proved reserves by country. The figure for Canadian oil reserves includes an official estimate of Canadian oil sands 'under active development'. Oil includes gas condensate and natural gas liquids as well as crude oil."

Facts of OPEC's spurious reserve additions known since 1999

The problem with the accuracy of OPEC reserve data is known for some time and was first addressed by Colin J. Campbell, a retired oil geologist from Ireland and founder of ASPO (Association for the Study of Peak Oil & Gas), during a presentation to a House of Commons All-Party Committee in 1999[1)] (when UK oil production peaked) and then continued to be debated in the following annual conferences of ASPO.

2001: Dick Cheney's Energy Task Force uncovered problems with Saudi oil fields

More detailed work on one of OPEC's members, Saudi Arabia, was done by the American investment banker and former advisor to Dick Cheney's 2001 Energy Task Force, Matthew

Simmons. He studied all giant oil fields world wide and found that daily world production depended surprisingly high on large, maturing fields and that newly discovered giants have been progressively smaller[2)]. During this work, Simmons became suspicious about the true status of oil reserves in Saudi fields.

Feb 2004: Aramco's answers to challenging questions unsatisfactory

The Center for Strategic and International Studies in Washington then invited Matthew Simmons[3)] and Saudi Aramco oil officials to a conference in February 2004 to discuss this issue. Aramco repeated earlier claims it could supply 10 million barrels of oil for the next 50 years but did not provide detailed, field-by-field reserves and past and projected future production data. In Aramco's presentation[4)], one slide revealed that Ghawar, the world's largest, super giant oil field (5 million barrels daily production, 6% of the global oil supply) is now 48% depleted and therefore shortly before its peak. **This information alone should be alarming.** The average depletion level of all Saudi fields was given as 28% but a later study (see below) by PFC Energy, Washington, found this to be rather 42%. At an annual depletion rate of 1% pa this would be equivalent to turning Saudi Arabia's oil depletion clock forwards by 14 years! The question of the validity of Saudi reserves remained unresolved (see Appendix 10.1)

May 2004: An article in the Oil & Gas Journal by Dr S. Al-Husseini adds more confusion to the Saudi reserve definition debate

The article[10)] starts by reiterating that "as of 2004, Saudi Aramco has established its oil reserves at 260 bn barrels" but later refers to it as a "reserve base". Out of this, 130 Gb are "remaining proven developed reserves" and 130 Gb are "discovered but undeveloped Saudi reservoirs". Prof Aleklett from Uppsala University in Sweden comments: "Reserves base is not proven reserves according to SEC, the Securities and Exchange Commission. That's the reason why Shell has to downgrade its reserves". (see Appendix 10.8)

June 2004: ASPO comments on Saudi reserves of 260 Gb

In its June 2004 Newsletter[11)], ASPO notes that "undeveloped reserves are evidently a good deal less than proved" and that these reserves may refer to "unconfirmed new discoveries with extreme assumed recovery factors, or even oil-in-place". ASPO's current assessment is that "97 Gb have been produced so far; that 144 Gb will come from known fields and 18 Gb from new discovery, giving a total of 260 Gb, the number claimed as remaining reserves. The article presents little evidence to counter ASPO's current forecast that production will be flat to at least the midpoint of depletion in 2013. The depletion rate at that point would be about 2.3%, which is still relatively low, meaning that plateau production could be extended for some years longer before terminal decline need set in." (see Appendix 10.8)

Jul 2004: IEA (International Energy Agency in Paris) addresses oil depletion issues, the 1st time after many Energy Outlooks ignored the issue

In July 2004, in a FVG and IBP workshop in Rio de Janeiro the editor of the monthly Oil Market Report, K. Rehaag from the International Energy Agency, presented a slide show asking the question "Is the World Facing a 3rd Oil Shock?"[5)] and notes that global reserves are

overstated for political reasons. A huge "challenge" lies ahead to find incremental barrels to offset depletion in 70% of oil fields. The IEA is not usually known for pessimistic outlooks. (see Appendix 10.2)

August 2004: Petroleum Review calculates 300 bn barrels OPEC oil overstated

In the August 2004 issue of the Petroleum Review[6)] (page 26-28) Dr M.G. Salameh, a consultant to the World Bank and UNIDO, **finds that around 300 bn barrels of OPEC oil have been overstated** as a result of OPEC's internal quota war in the 1980s. His article is supported by calculations from Prof. Kenneth S. Deffeyes of Princeton University. Dr. Salameh concludes:

"The current global reserves/production (R/P) ratio is 37 years based on global proven reserves of 1047.7 bn barrels (at the beginning of 2003) and an annual production of 28 bn barrels. A downward revision of OPEC reserves by 300 bn barrels will reduce the R/P ratio by 10 years to 27….. However, whether the figure is 37 or 27 years, one has to realise that oil production will not stay flat during that period and then suddenly drop to zero. Rather, it will rise to peak after which mankind is faced with an era of declining production. Thus it is clear that 'peak production' will be an important turning point in our future reliance on oil and, therefore, consumers and governments alike should be made aware how close such a date might be." (underline added by author)

A simple R/P calculation is oil-geologically irrelevant

It is important to note that a simple, even revised R/P calculation 750/28=27 years is grossly misleading and unrealistic because one cannot just distribute remaining oil reserves freely over any period of time. The future production of oil is determined by a complex set of parameters including economic, financial, geo-political, technological and, **above all, oil-geological factors** and must be computer modeled, field by field, using technical reserve and historic production data. The flow of oil in source rock is controlled by the laws of fluid mechanics. Advanced technology can speed up the flow of oil to a certain extent but cannot change the oil geological characteristics of each field in principle, especially not after peak oil. Therefore, future production profiles cannot be forced, by wishful thinking, into any flat or even ever growing demand curves. (see Appendix 10.3)

Sep 2004: Continuing worries about Saudi oil fields

In September 2004, Matthew Simmons sums up his latest findings at the Hudson Institute, Washington[7)] and presents slides entitled "This Middle East Energy Belief is an Illusion" and "Why I worry about Saudi Arabia's Oil" with an outlook on water injection and future tertiary recovery techniques in maturing Saudi fields. (see Appendix 10.4)

Sep 2004: PFC Energy study in Washington finds OPEC's oil is depleting

Also in September 2004, the Center for Strategic and International Studies in Washington published a report from PFC Energy "Global crude oil and natural gas liquids supply forecast"[8)] highlighting i.a. the depletion rates of various OPEC countries (e.g. Saudi Arabia: 42%; Nigeria 50%; Iran: 50%; Qatar: 62%; Venezuela: 58%) which suggests that these countries are in a phase of transition from growth to decline. In the case of Saudi Arabia, this is of great concern (see Appendix 10.5)

Oct 2004: Analysis of PFC Energy report confirms OPEC reserves only 506 bn barrels, not 882 bn barrels

In the October newsletter of ASPO[9)], Chris Skrebowski, editor of UK Petroleum Review, analysed PFC Energy's data and writes: **"The immediate conclusions are that OPEC with the exception of Indonesia, Algeria, Libya and just possibly Nigeria are supplying BP with their total discovered rather than their remaining reserves."** The 'total discovered reserves' include oil which has already been produced and consumed. The PFC Energy report implies that BP's reported OPEC reserves of 882 bn are in fact only 506 bn, a massive reduction (see Appendix 10.6)

Oct 2004: The International Energy Agency confirms overstated OPEC reserves

The IEA released its latest World Energy Outlook end of October 2004, in which one can find following paragraph:
"According to BP, reserves increased dramatically in the 1980s and 1990s, from 670 billions barrels at the end of 1960 to 1147 billion barrels at the end of 2003. But most of the increase occurred in OPEC countries, mainly in the Middle East, in the second half of the 1980s. Saudi Arabia and Kuwait revised their reserves upward by 50%, while Venezuelan reserves were boosted 57% by the inclusion of heavy oil in 1988. The United Arab Emirates and Iraq also recorded large upward revisions in that period. Total OPEC reserves jumped from 538 billion barrels in 1985 to 766 billion barrels in 1990. As a result, world oil reserves increased by more that 30%. This hike in OPEC countries' estimates of their reserves was driven by negotiations at that time over production quotas, and had little to do with the actual discovery of new reserves. In fact, very little exploration activity was carried out in those countries at that time. Total reserves have hardly changed since the end of the 1980s."
Strangely enough however, this acknowledgement does not seem to have entered IEA's figure 3.20 in WEO 2004 (see Appendix 16) which is based on the USGS 2000 mean estimate and contains the uncorrected OPEC reserves. Therefore, the USGS mean estimate would have to be reduced accordingly, including its 44% reserve growth addition. (See Appendix 16 page 4 and reference #12 for details)

The IEA has put Governments on notice that peak oil may come before 2015 if the USGS 2000 mean estimate should prove too high.

Australia's energy white paper has got it all wrong

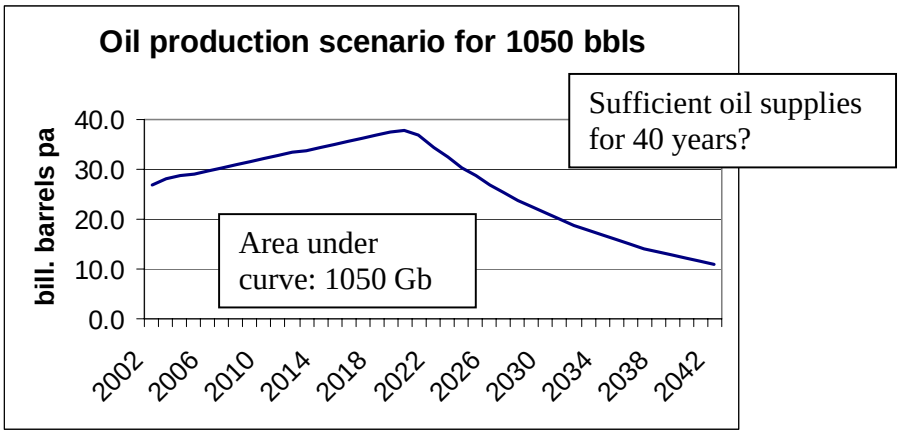
The Federal Government's energy white paper "Securing Australia's Energy Future" is based on the assumption there are world reserves of 1050 bn barrels of oil and that these are sufficient to supply world demand for around 40 years. **One must now ask why were these absolutely vital oil reserve data not independently checked and confirmed by the Government?**

The energy white paper, in which these assumptions are made, is already flawed in principle even with its currently quoted figures. It contains 3 mutually exclusive statements:

1. global oil reserves of 1050 bn barrels (page 119, quoted from BP 2003)
2. increasing daily oil production to 104 million barrels in 2020 (page 120, quoted from IEA 2002)

3. "sufficient reserves to supply world demand for around 40 years" (page 119, Government's own thinking)

Let us put this into a graph and check the arithmetic:



Geometric production scenario (not oil-geological forecast) using the energy white paper's quoted reserves of 1050 Gb (BP 2003) and production increasing to 104 mbd in 2020 (WEO 2002). Supplies would have to drop by 6% pa after 2020 to respect total reserves. Reserve additions of 150 Gb (as estimated by ASPO) over 40 years have been incorporated and these would be available at the end of this period so that production in this graph does not peter out to zero.

Statements 1 AND 2 AND 3 are mutually exclusive as the above graph shows. If production increased up to 104 mbd in 2020, already around 600 bn barrels would be produced by 2020, leaving just 450 bn for the remaining period of 22 years which would require a 6% annual decline in order not to exceed the total reserves of 1050 bn. And this simple calculation assumes that the initial increase would be geologically feasible.

Statement (3) should actually read "There are global oil reserves equal to 40 years of current world consumption", which is completely different. The functional dependency between production and reserves, largely controlled by oil-geology, is non linear. Production over time always follows a bell shape type of curve (Hubbert's curve) with decreasing production after the peak. Therefore, it may take up to 70 years or more until 1050 barrels can be physically produced.

Together with serious doubts now hanging over the 1050 bn barrels reserve figure itself, **the Federal Government's notion of sufficient oil supplies for 40 years is absolutely untenable**. The energy white paper in its current version will lead to a huge mis-allocation of funds for new transport infrastructure (overshooting) and a continuing inactivity in relation to the development of alternative transportation fuels. **The energy white paper should therefore be withdrawn from circulation or ignored.**

Read about how quickly oil production growth can turn into decline in Appendix 10.7 and a summary of the world's current oil supply situation in Appendix 12

New Transport Policy absolutely urgent

The above has huge repercussions on the transport-, road-, rail- and airport infrastructure policy, on urban development strategies and the agricultural sector all of which have to take into account the approaching peak of oil production and its decline thereafter.

Prepared by

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References:

1) Presentation to a House of Commons All-Party Committee in 1999 by C.J. Campbell **http://www.hubbertpeak.com/campbell/commons.htm**

2) Matthew Simmons; The World's Giant Oilfields, Hubbert Center Newsletter 2002/1 http://hubbert.mines.edu/news/Simmons_02-1.pdf.

3) CSIS conference in Feb 2004; Matthew Simmons' slide show „The Saudian Oil Miracle" www.csis.org/energy/040224_simmons.pdf

4) CSIS conference in Feb 2004; Abdul Baqi and Nansen Saleri's slide show: "50 year crude oil supply scenario, Saudi Aramco's perspective" www.csis.org/energy/0404224_baqiandsaleni.pdf

5) FVG and IBP Workshop in Rio; slide show by K. Rehaag (International Energy Agency) "Is the world facing a 3rd oil shock?" www.iea.org/dbtw-wpd/Textbase/speech/2004/kr_**rio**.pdf

6) Petroleum Review August 2004, page 26-29; article from Dr. Salameh "How realistic are Opec's proven oil reserves?" www.odac-info.org/welcome/documents/SALAMEH-PETREVIEW.pdf

7) Slide show by Matthew Simmons at the Hudson Institute: "Twilight in the desert; The Fading of Saudi Arabia's Oil" http://www.simmonsco-intl.com/files/Hudson%20Institute%20September.pdf

8) PFC Energy's report dated September 2004: "Global crude oil and natural gas liquids supply forecast" www.csis.org/energy/040908_presentation.pdf

9) ASPO Newsletter October 2004, item 430 by Chris Skrebowski: "A remarkable presentation by Washington" http://www.asponews.org/docs/newsletter46.pdf

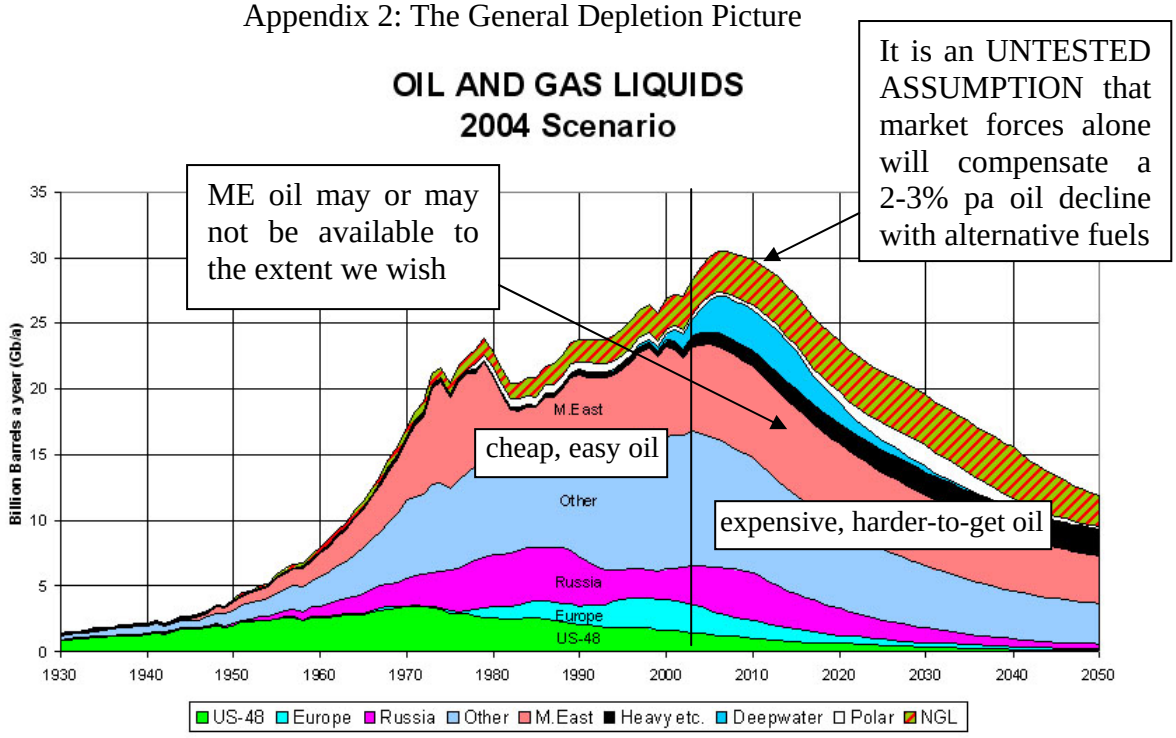
10) Article in the Oil & Gas Journal, May 2004, by Dr. S. Al-Husseini "Saudi Arabia's Oil Reserves"; also available at the web site of the Saudi-American Forum http://ogj.pennnet.com/Articles/Article_Display.cfm?Section=Articles&ARTICLE_ID=204659

11) ASPO Newsletter June 2004, item 365 "Saudi Reserves – a false alarm and a confession" http://www.asponews.org/docs/newsletter42.pdf

12) "International Energy Agency accepts Peak Oil", analysis of chapter 3 of the WEO 2004 by Prof. Aleklett, Hydrocarbon Depletion Study Group, Uppsala University, Sweden www.peakoil.net

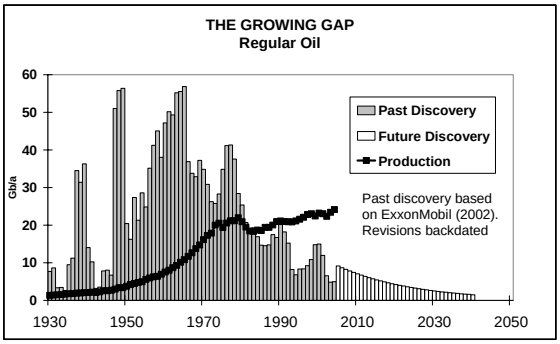
Latest update: 27/1/2005

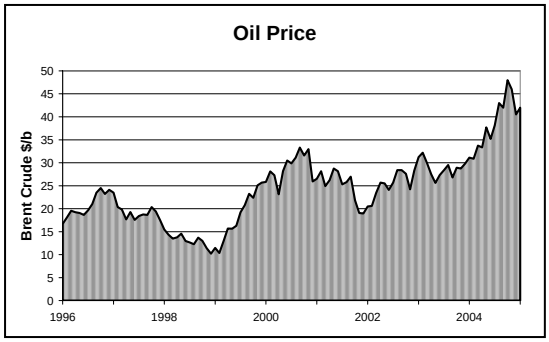
Appendix 2: The General Depletion Picture



ASPO's annual oil production simulated on the basis of technical reserve and production data. Half of the regular oil is already consumed. Though higher oil prices will result in exploration and production from new fields (+135 Gb) future production is limited by oil geology. Peak oil will trigger a general energy crisis as the world will seek to fill the gap. Our economy and transport systems will have to adapt. Prudent governance requires that we change our current energy & transport policies NOW before the crisis manifests itself.

ESTIMATED PRODUCTION TO 2100									End 2004
Amount			Gb	Annual Rate - Regular Oil					Gb	Peak
Regular Oil				Mb/d	2005	2010	2020	2050	Total	Date
Past	Future		Total	US-48	3.4	2.7	1.7	0.4	200	1972
Known Fields		New		Europe	5.2	3.6	1.8	0.3	75	2000
945	760	145	1850	Russia	9.1	8	5.4	1.5	220	1987
	905			ME Gulf	20	20	20	12	680	1974
All Liquids				Other	28	25	17	8	675	2004
1040	1360		2400	**World**	**66**	**59**	**46**	**22**	**1850**	2006
2004 Base Scenario				Annual Rate - Other						
M.East producing at capacity				Heavy etc.	2.4	4	5	4	160	2021
(anomalous reporting corrected)				Deepwater	4.8	7	6	0	70	2014
Regular Oil excludes oil from				Polar	0.9	1	2	0	52	2030
coal, shale, bitumen, heavy,				Gas Liquid	8.0	9	10	8	275	2027
deepwater, polar & gasfield NGL				Rounding		0	2		-7	
Revised 26/01/2005				**ALL**	**82**	**80**	**70**	**35**	**2400**	2007





Peak production follows peak discovery (in the mid 1960s) with a time lag.

Source of graphs: Association for the Study of Peak Oil & Gas, at www.asponews.org

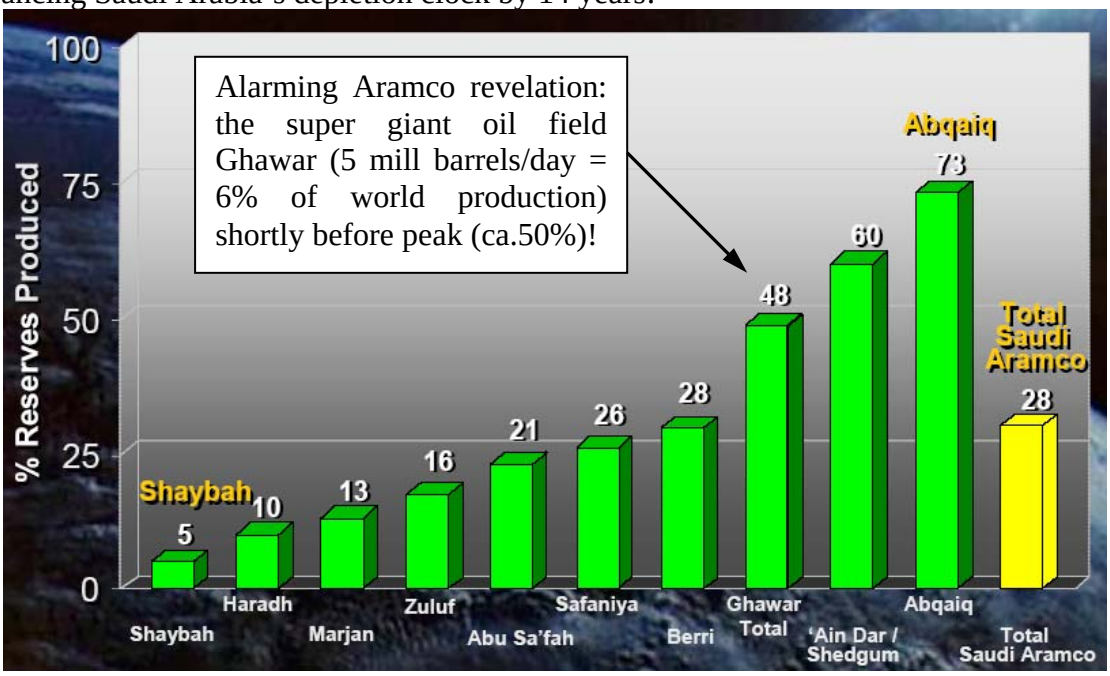
Compiled by C.J.Campbell, Staball Hill, Ballydehob, Co. Cork, Ireland Last Update: 3/2/2005

Appendix 10.1: "Future of Global Oil Supply: Saudi Arabia"
Conference at the Center for Strategic and International Studies, Washington, Feb. 2004

Matthew Simmons, an American investment banker (http://www.simmonsco-intl.com/), who participated in Dick Cheney's Energy task force in 2001, had done a study on the world's giant oilfields, many of which are now mature. He came across 200 Saudi technical papers which seemed to indicate problems associated with advanced depletion in certain fields. Reflecting worries about these findings, some critical questions on depletion levels in Saudi fields were put before Aramco officials attending the conference:

Source: http://www.csis.org/energy/0404224_simmons.pdf

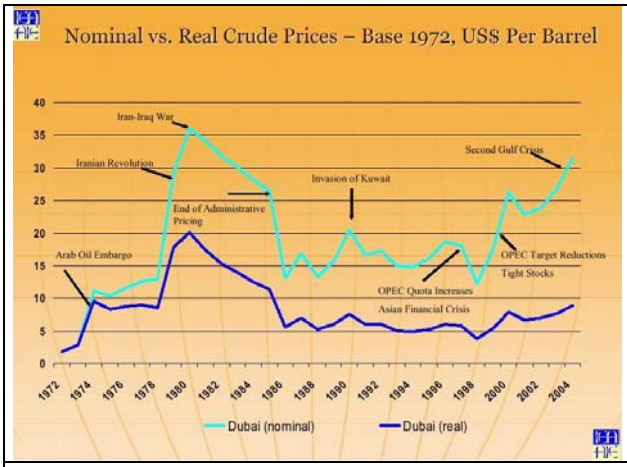
In reply, Saudi Aramco's officials repeated the usual assurance of 50 years of oil supplies at 10-12 million barrels per day, but one slide revealed that the super giant oil field Ghawar (5 mbpd) is 48% depleted. This alone would be of concern as peak normally occurs at the mid point. Massive injection of highly corrosive salt water is needed to support reservoir pressure. The oil coming from horizontal multiple head wells, indicating advanced recovery techniques to maintain production, contains already 36% water. A slide was shown with an average depletion level for all Saudi fields of 28%, but PFC Energy (Washington) later calculated this to be rather 42%. At a depletion rate of 1% pa this would be equivalent to advancing Saudi Arabia's depletion clock by 14 years!



Source: www.csis.org/energy/0404224_baqiandsaleni.pdf

Appendix 10.2: Is The World Facing a 3rd Oil Shock?

This was the question asked by K.Rehaag, editor of the IEA's monthly Oil Market Report, during a workshop presentation in Rio de Janeiro in July 2004.

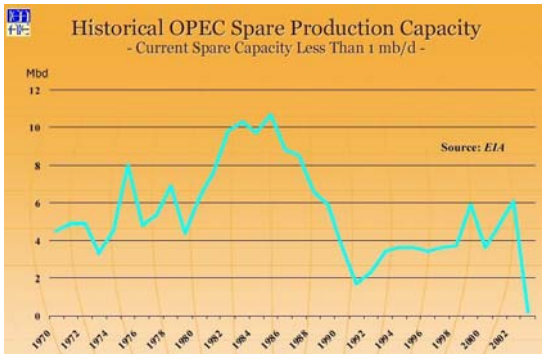


Historic crude oil price hikes:

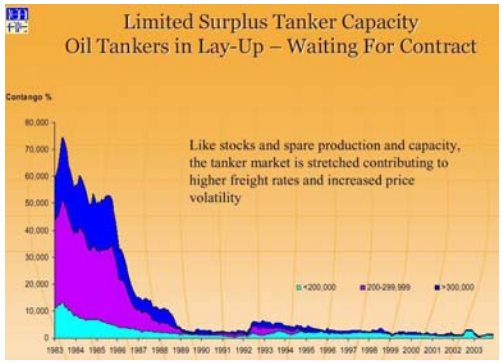
- 1973 Arab oil embargo after Jom-Kippur war
- 1979 Iranian revolution
- 1980 Iran-Iraq war
- 1990 Invasion of Kuwait
- 1999 Opec target reductions
- 2003 Iraq war

upper curve: nominal crude prices
lower curve: real crude prices
Note: for almost 20 years real prices have been fairly constant

Tight spare capacity leads to price volatility, market instability and fosters speculation

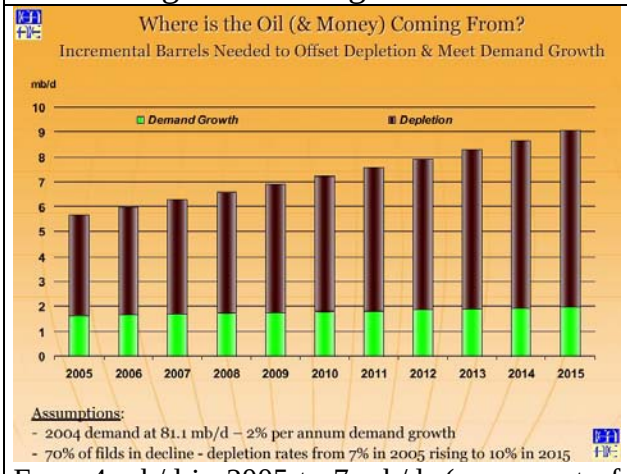


OPEC's spare capacity down to 1 mb/d



Tanker capacity stretched since 1st gulf war

Challenge: Increasing amounts of oil needed to offset depletion in mature fields



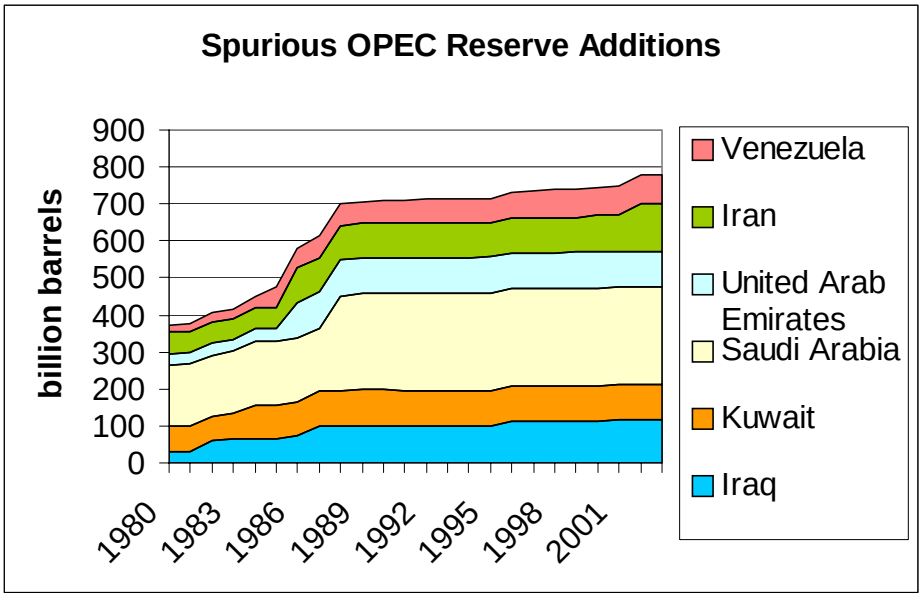
From 4 mb/d in 2005 to 7 mb/d (upper part of column) required to compensate decline in 70% of fields with depletion rates of 7% in 2005 rising to 10% in 2015.
Demand growth 2% pa (lower part of column)

- IEA expects continued growth in Non-Opec supply but….
- New discoveries are smaller fields
- Global reserves over stated for political reasons
- Supply constraints will push up price, limit demand growth, negatively impact & curtail economic growth
- Shift to more expensive, risky and non-conventional areas
- Important role of technology (3D,4D, offset drilling, computing power etc)
- Immediate problem is not running-out of oil but access to reserves
- While political embargo is less likely, some argue global economy faced with supply crunch with devastating results
- High demand growth could over-tax system

Source of graphs and content: www.iea.org/dbtw-wpd/Textbase/speech/2004/kr_**rio**.pdf (colors reversed)

Appendix 10.3: OPEC Reserve Additions in the 1980s

In the 1980s, reserves quoted by BP (as reported by Governments) experienced an unusual increase (graph below). This long known fact attracts interest and analysis now as the world starts to look for where the remaining oil is. The UK Government asked for more transparency in OPEC reserve data. In plain English: the world is flying blind as far as OPEC oil reserves are concerned. In Petroleum Review[1)], August 2004, Dr. M.G. Salameh, a consultant to the World Bank and UNIDO, tries to shed light on this question

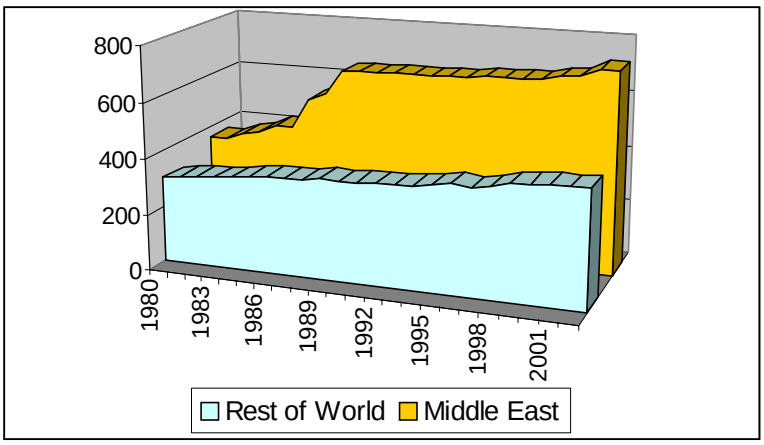


Reserve history in 6 OPEC countries: sudden jump of reported reserves between 1982 and 1988 by 293 bn barrels equivalent to 5 times the initial North Sea reserves. Source: BP Statistical Review World Energy 2004

by calculating that OPEC's reserves at the beginning of 2003 should be **520 bn rather than 820 bn barrels**, based on the following observations:

- there were no exploration or drilling efforts during that period which would have justified the size of the additions
- these are political reserves designed to position each country favourably under quota rules introduced in the early 80s which also included reserves
- upward revisions of earlier, conservative estimates of oil in place - done by oil companies before nationalization - were exaggerated
- the recovery rate applied to the oil in place was increased from 20% to 50% while the world average is rather in the order of 30%
- the reserves could result from the mixture of all of the above

Prof. Kenneth S. Deffeyes from Princeton University comes to similar conclusions



Source: BP Statistical Review of World Energy 2004

Middle East's implausible reserve history compared to an only slightly increasing reserve curve for the rest of the world caused by rather modest revisions and additions from small new fields (in bn barrels of oil). Another North Sea sized reserve was added in 2004 to smaller ME reserves already published in 2003.

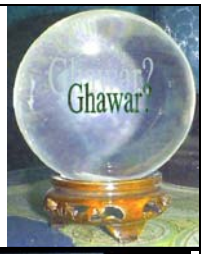
1) www.odac-info.org/welcome/documents/SALAMEH-PETREVIEW.pdf

Appendix 10.4: Twilight in the Desert: The Fading of Saudi Arabia's Oil
Summary from a presentation by Simmons & Company Intl. in 9/2004

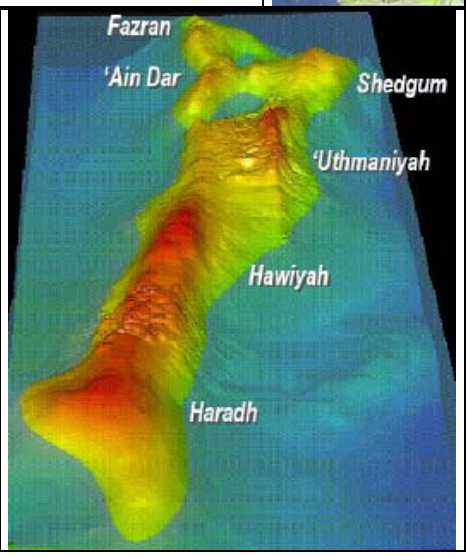
Conventional Wisdom	Reality
All long term oil supply/demand models assume ME oil can grow as fast as demand rises	7 key fields produce 90%+ of Saudi oil; average life is 45-50 years
Middle East oil will also be cheap	When water injection/drive ends, costs become very high
If more oil is needed, drill anywhere	Middle East oil is in the golden triangle; few giant oil fields were found after the mid 1960s
Energy planner's assumption: Saudi Arabia can produce 10-25 mb/day	No solid data on any aspect of Saudi oil. Analysis of 200 technical papers is troubling
Many discovered but yet to be produced fields are waiting in the wings	New projects are merely offsetting declining production in mature fields
There are large unexplored areas with plenty of oil	Unexplored areas are: Iraq's southern border, deepwater Red Sea, bottom end of empty quarter

Saudi oil is shrouded in secrecy

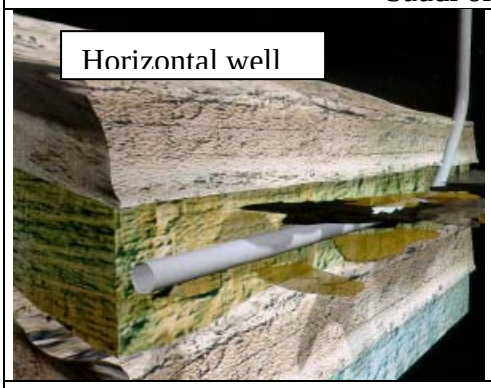
Key secrets: How much oil is produced? How many proven reserves are really proven? What is the average well productivity? How much spare capacity really exists? What are the production volumes of each field? What will the decline by field be? Will the crystal ball help?



Field	mb/day(1994)	Problems
Ghawar	5,000,000	55%-65% of Saudi oil produced between 1951 and 2004. Water cut is 33%.
Safaniya	960,000	Is losing water aquifer
Abqaiq	650,000	Down from 1 mill in 1973; pockets of by-passed oil
Berri	400,000	Down from a 1977 peak of 790,000. Future gas field.
Zuluf	500,000	Is losing water aquifer
Marjan	400,000	Is losing water aquifer
Abu Sa'fah	150,000	Will use massive numbers
Total	8,060,000	(9,600,00 in 2003)



Saudi oil fields depletion stages



Aggressive use of water management has kept prime reservoir pressures high, which led to extremely high flow rates. In the late 1990s vertical production wells watered up fast and are now obsolete. Well productivity has been steadily declining.

Extended reach horizontal wells, maximum reservoir contact wells and intelligent wells with automatic water shut off valves are finishing the secondary sweep

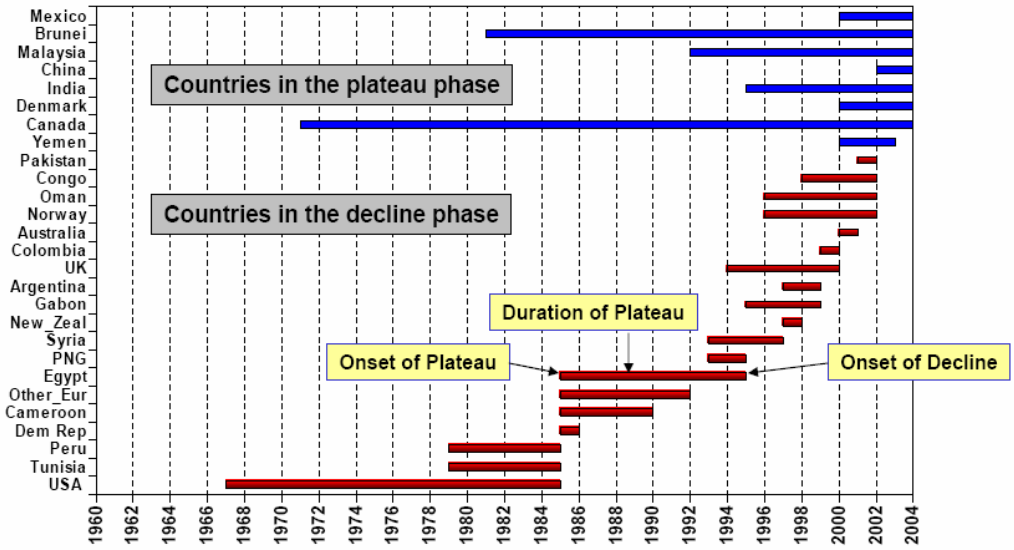
Artificial lift/tertiary recovery can extract more oil but many more wells are needed, most fluid produced will be water, not oil. Future fields like Khurais are more challenging.

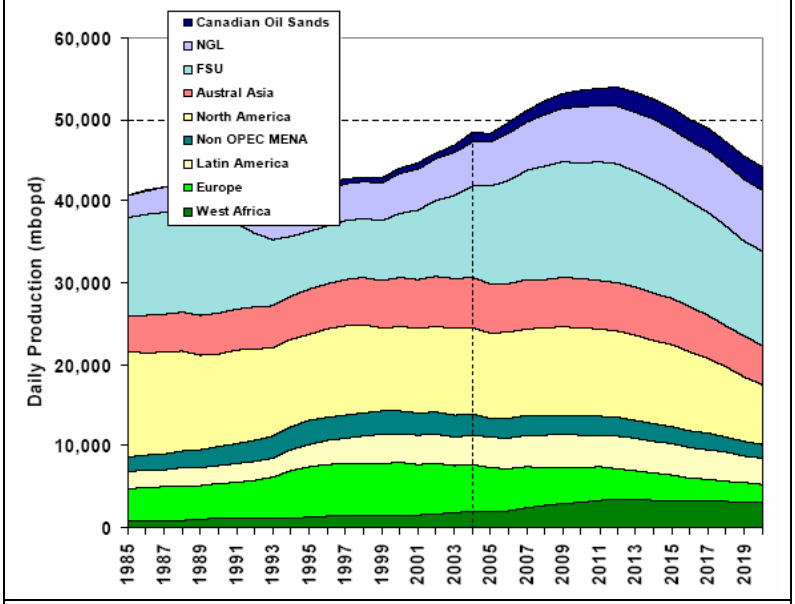
>>>When Ghawar's oil output declines, Saudi's oil will have peaked

Source: http://www.simmonsco-intl.com/files/Hudson%20Institute%20September.pdf

Appendix 10.5: "Global Crude Oil and Natural Gas Liquids Supply Forecast"
Center for Strategic and International Studies, by PFC Energy, Sep 2004

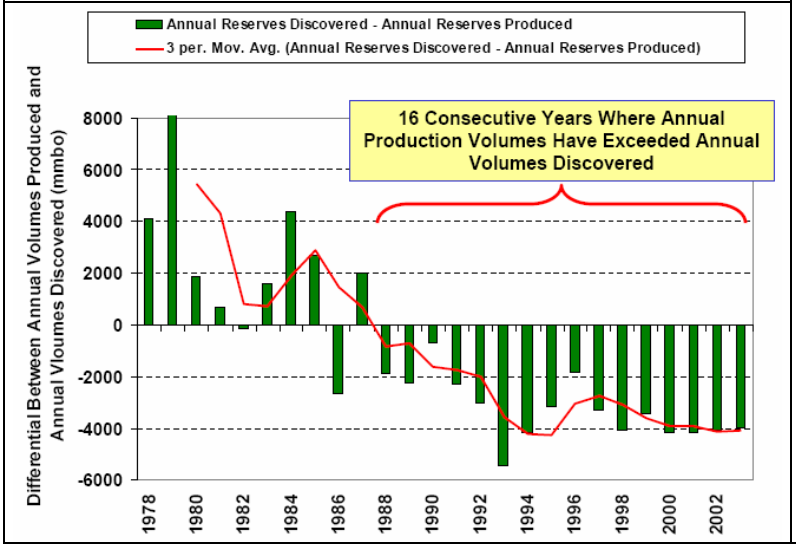
The graph below shows Non-OPEC countries in decline or on a plateau; the number of countries passing from peak to decline is accelerating





Global Non-OPEC Total Liquids with New Exploration

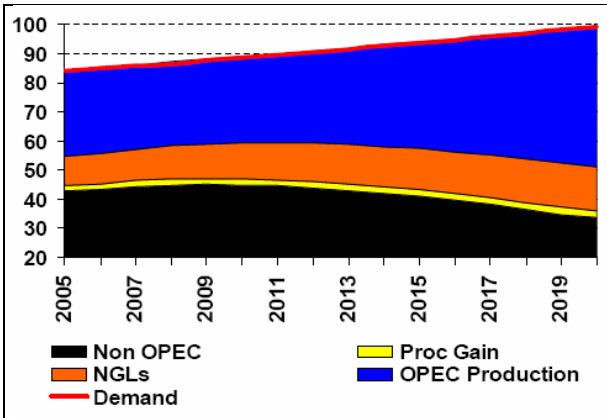
A rather optimistic estimate in relation to FSU oil and tar sands in Canada which require huge amounts of gas for processing. It will also require substantial success in exploration efforts which is by no means guaranteed. Note that compared to ASPO, PFC's peak moves down only a couple of years from 2007 to 2012. No big difference in principle for the usual Cost Benefit Analysis covering a period of 25 years.



Annual Crude Production Balance

(Excluding OPEC, FSU, NGLs and Canada)

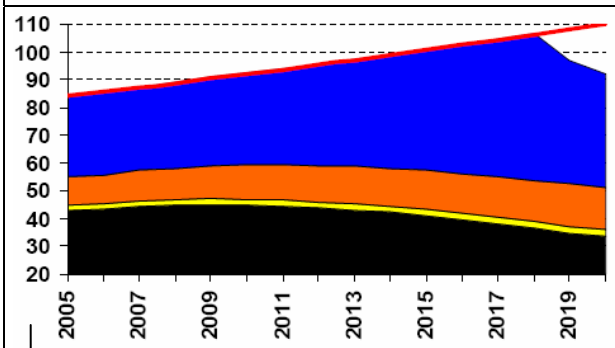
The world is consuming more than we are discovering for a long period of time now. We clearly draw down our reserves.



3 Optimistic Oil Production Scenarios

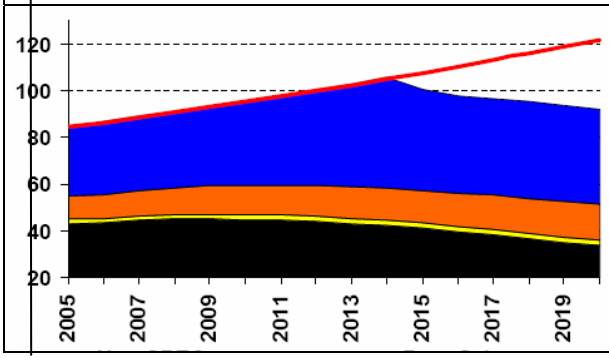
Low Demand Growth: 1.1%

A typical demand growth curve up to 2020 (100 million barrels/day). One would think the curve could go on climbing for ever. But the decline part of the curve is hidden outside the graph's conveniently defined period. The gap between demand and Non-OPEC plus NGL supply is simply filled by OPEC. But can OPEC really deliver?



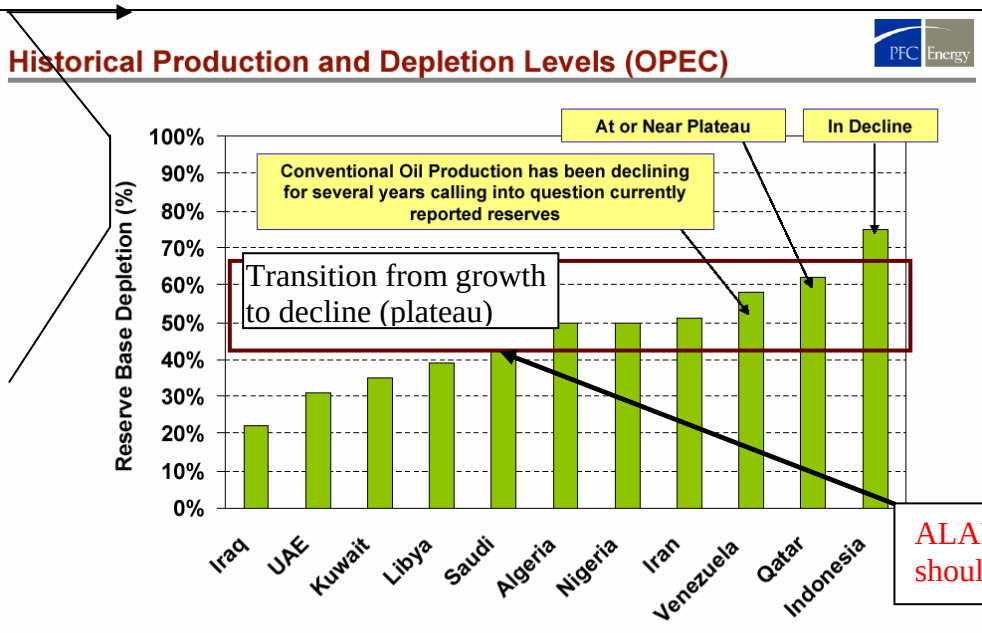
Base Case: 1.8% Growth

The demand curve is moved higher and, oops!, that peak which was hidden in the low growth scenario comes into the picture! And the decline after that peak is steep, too. One would not be sure if any economy would survive such a production crash!



High case: 2.4% Growth

The demand curve goes another notch higher and the peak moves forward. Again OPEC fills the gap. In this scenario, we would have 10 years time to renew our car fleet and build up alternative fuel supply systems to fill the oil supply gap after the peak. Every year counts.



annual oil production

Source: www.csis.org/energy/040908_presentation.pdf

Appendix 10.6: Revision of OPEC reserves
As calculated by Chris Skrebowski, editor of Petroleum Review, Oct 2004

In Sep 2004, the Center for Strategic and International Studies, Washington, published a report from PFC Energy entitled "Global crude oil and natural gas liquids supply forecast" listing many countries with their respective oil depletion levels. Chris Skrebowski, editor of Petroleum Review, has analysed these lists and compiled following table (1Gb = 1 billion barrels) by combining information from 3 other sources, namely:

1. Association for the Study of Peak Oil & Gas http://www.peakoil.net/
2. Dr. Salameh, consultant to the World Bank and UNIDO, article in Petroleum Review 8/2004 "How realistic are OPEC's proven oil reserves?" www.odac-info.org/welcome/documents/SALAMEH-PETREVIEW.pdf
3. BP Statistical Review World Energy 2004 (end 2003) http://www.bp.com/

1	2	3	4	5	6	7	8	9
OPEC	Cum Prod End 2003	% Depleted	Indicated Total	Remaining Reserves Gb PFC	ASPO	Salameh	BP	BP Estimates Interpreted
Iraq	28	22%	127	99	62	62	115	Total Discovered
UAE	19	31%	61	42	49	37	98	Total Discovered
Kuwait	32	35%	91	59	60	71	97	Total Discovered
Libya	23	39%	59	36	29	26	36	
Saudi	97	42%	231	134	144	182	263	Total Discovered
Algeria	13	50%	26	13	14	11	11	
Nigeria	23	50%	46	23	25	20	34	? High Estimate
Iran	56	51%	110	54	60	64	131	Total Discovered
Venezuela	47	58%	81	34	35	31	78	Total Discovered
Qatar	6.8	62%	11	4.2	4.1	4.6	15	Total Discovered
Indonesia	20	75%	27	6.7	9.4	12	4.4	
TOTAL	**365**		**870**	**506**	**492**	**520**	**882**	
NON-OPEC								
China	30	61%	49	19	24		24	
Mexico	31	48%	65	22	22		16	
Brunei	3.1	58%	5.3	1.2	1.2		1.1	
Malaysia	5.6	61%	9.2	4.0	4.0		4.0	
Denmark	1.5	61%	2.5	1.0	1.0		1.3	
India	5.8	66%	8.8	4.9	4.9		5.6	

Source: http://www.asponews.org/docs/newsletter46.pdf

Col 2: Cumulative production in Gb to the end of 2003 from ASPO	Col 6: ASPO's remaining reserves
Col 3: depletion levels from the PFC study	Col 7: Salameh's remaining reserves
Col 4: PFC's total reserve assumption (Col 2 divided by Col 3)	Col 8: BP's remaining reserves
Col 5: PFC's remaining reserves (Col 4 minus Col 2)	

The difference between PFC's assumed remaining reserves and those published by BP is huge. Skrebowski comes to the following conclusions:

(1) "OPEC with the exception of Indonesia, Algeria, Libya and just possibly Nigeria are supplying BP with their total discovered rather than their remaining reserves"

(2) "OPEC's reserves are around the 500 Gb mark, or 300-400 Gb short of what is generally assumed"

(3) In addition to 18 countries which were already identified (in Petroleum Review 8/2004 page 42) having declining production, more countries like Qatar, Iran and Algeria will join this group. The most worrying news, however, is that Saudi Arabia is approaching a plateau

The 18 countries in decline produced 22 mb/d in 2003, the next group of countries, now on a plateau, to approach the phase of decline produced 28 mb/d. Once this happens, 50 mb/d will be in decline which cannot be offset any longer by increasing production elsewhere.

Skrebowski, taking into account current new mega projects, writes: **"I'll be surprised if we make it to 2008 before the inexorable production decline begins"**

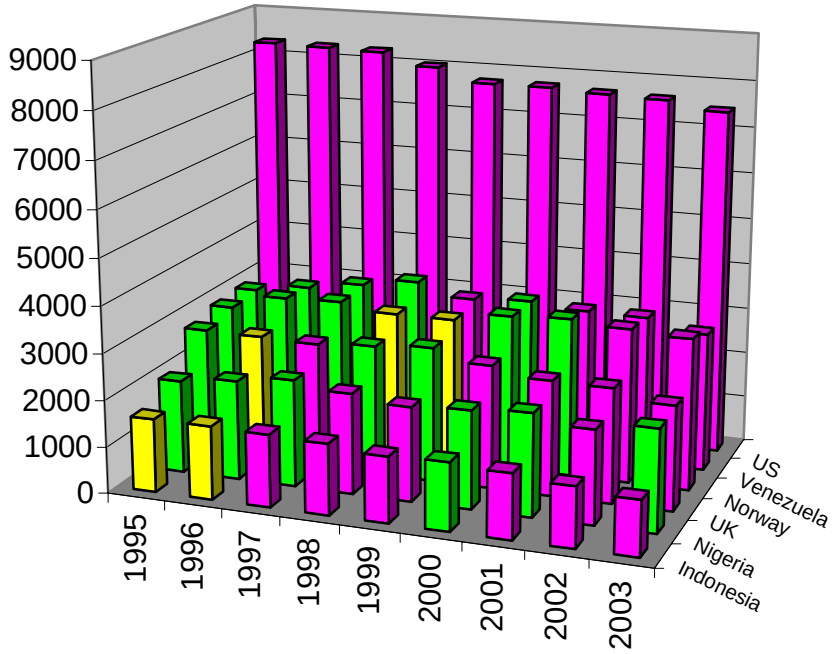
Latest update: 11/11/04

Appendix 10.7: Transition from Growth to Decline

In the coming years, more and more countries are joining a growing group of countries with declining oil production. In 2003, with a daily production of 22 mill barrels per day, their world market share had already reached 29% of the total of 77 mb/d.

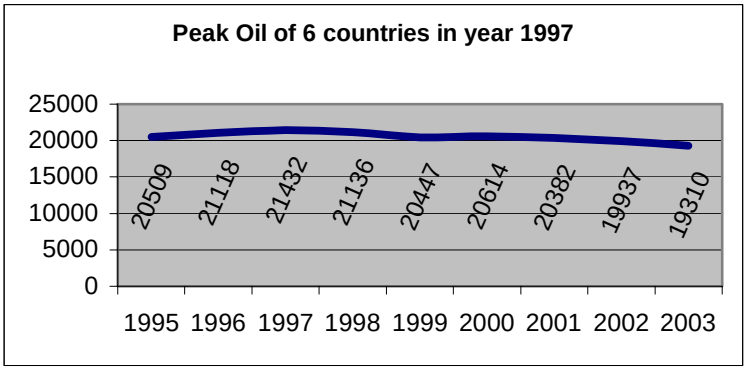
Green: growth
Yellow: flat
Red: decline

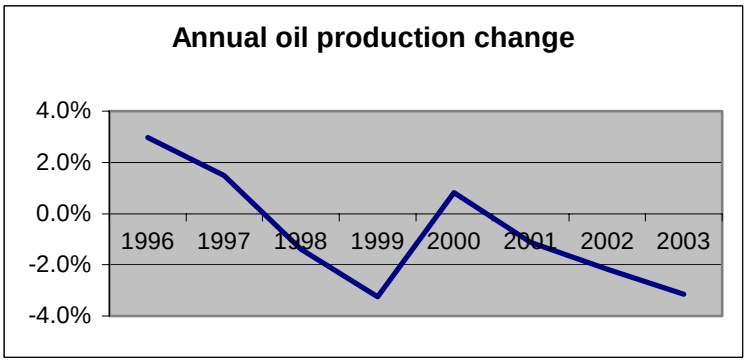
Daily oil production greater than 1 million barrels per day during the 1995-2003 period in 6 countries with a trend of declining oil production.



2003 Production in 1,000 bpd	
US	7,454
Venezuela	2,987
Norway	3,260
UK	2,245
Nigeria*	2,185
Indonesia	1,179
Total	17,125

* special case excluded from total

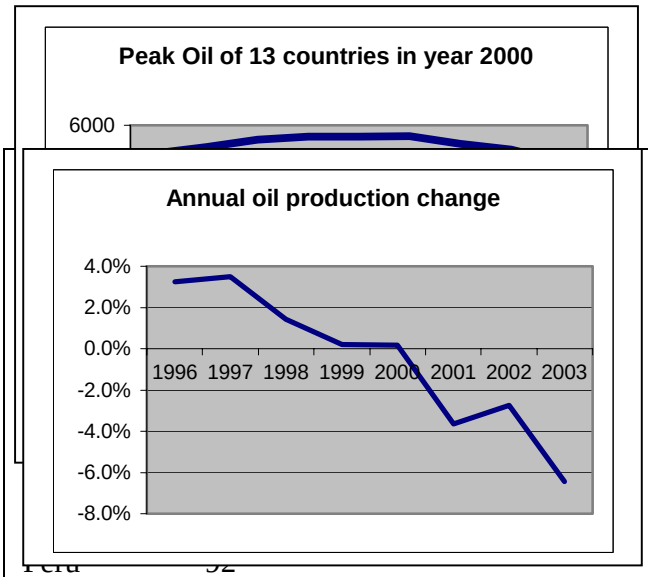




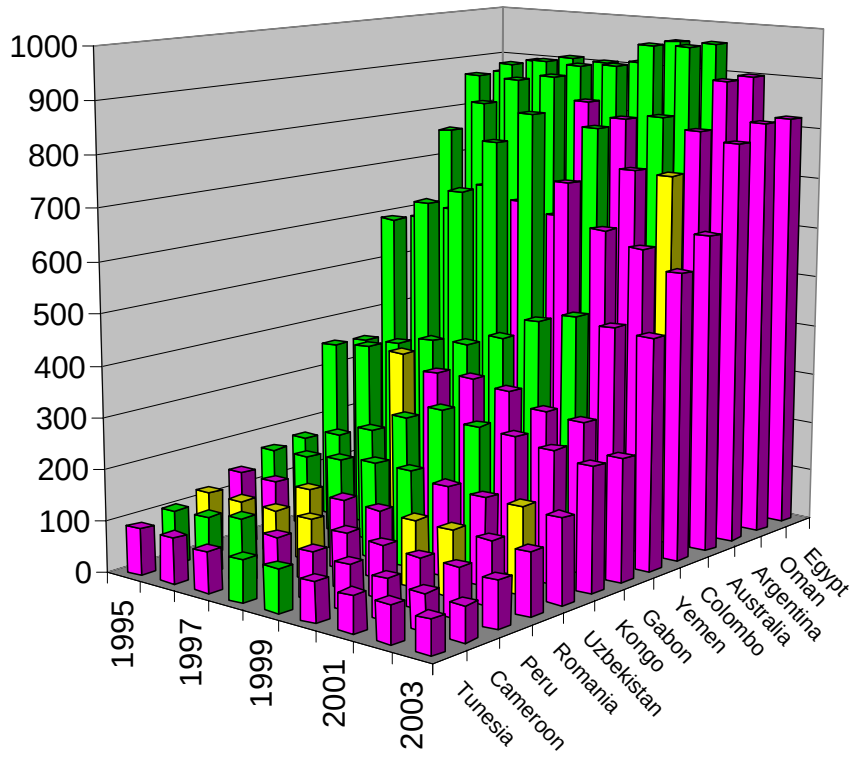
There are 2 peaks here with the derivative crossing the 0% line twice into the negative decline area.

The superimposition of several production curves from different countries in various stages of depletion will always result in a bumpy plateau around the peak.

Very important are the decline rates after the peak. They seem to accelerate into the 4% area just 2-3 years after the peak. Whether our economy and transport system can adapt will depend on whether a critical decline rate is not exceeded.



Cameroon	68
Tunesia	66
13 countries	5,006

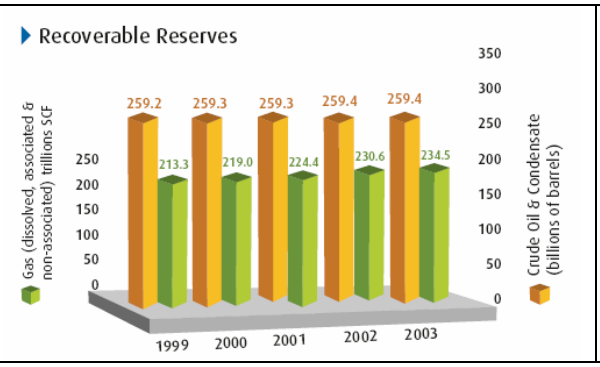


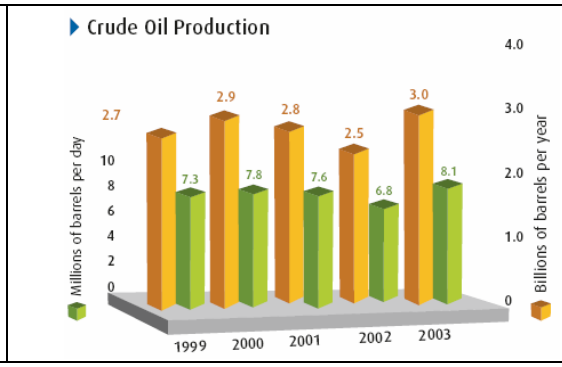
Daily oil production less than 1 million barrels per day during the 1995-2003 period in 13 countries with a trend of declining oil production. **The change over from growth to decline happens in a short time without much warning** (few yellow colored columns representing a transitional phase of flat production).

In the last 3 years before the peak in 2000, production still increased by an average of 2.7% pa,

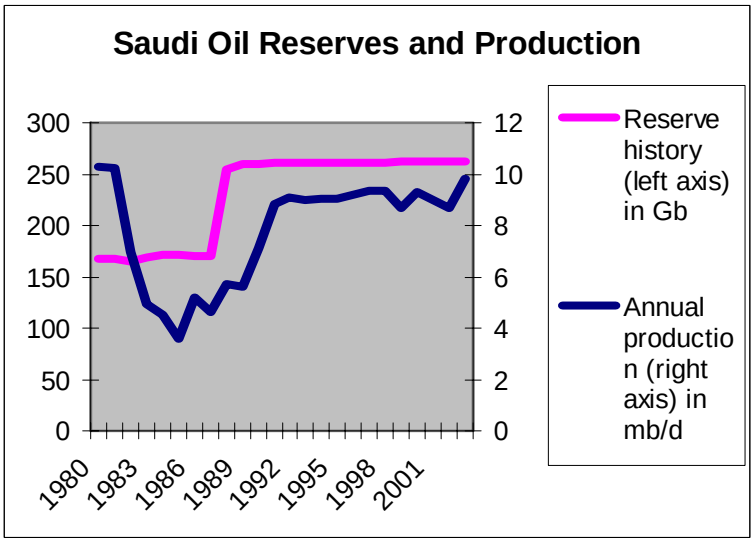
Appendix 10.8 Saudi Arabia's Oil Reserves and Production

Recoverable Reserves and Production from Aramco's Annual Review 2003





Aramco reports oil reserves constant almost to the decimal point over several years (left). Unless new discoveries exactly equal production (right), year by year, the reserve graph suggests these are total reserves ever found, not remaining reserves.

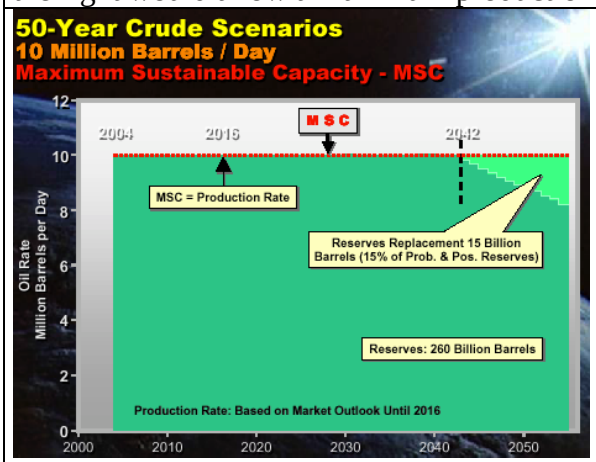


OPEC's internal quota war

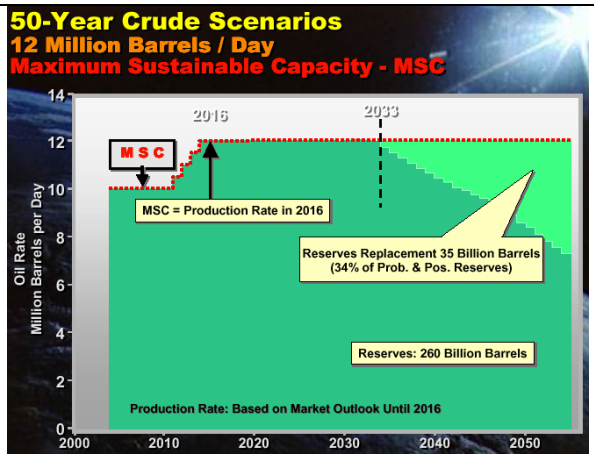
BP's Statistical Review data show a big jump (left, ca. 100 Gb) of Saudi reserves in the late 1980s which allowed higher production under a then newly introduced OPEC quota system. The IEA[1)] writes: "the hike ...was driven by negotiations over production quotas, and had little to do with actual discovery of new reserves. In fact, very little exploration activity was carried out .... at that time."

[1)]WEO 2004

50 year crude scenarios (not forecasts) as presented by Aramco's Abdul Baqi (Vice president of exploration) and G.Saleri (Manager of reservoir engineering) before the Center for Strategic and International Studies (Washington) in Feb. 2004[2)]. The left graph indicates **no intention to increase production beyond 10 million barrels/day** (currently at 9.5 mb/d). The scenario on the right would allow a maximum production of 12.5 mb/d from 2016 to 2033.



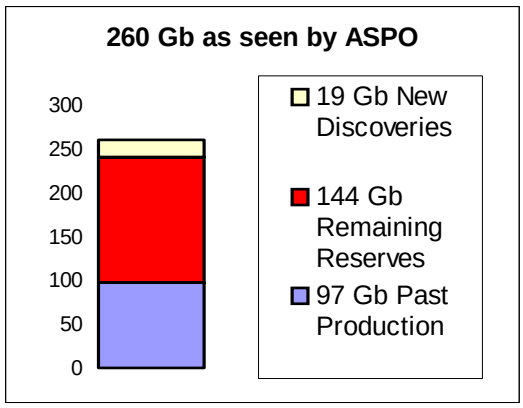
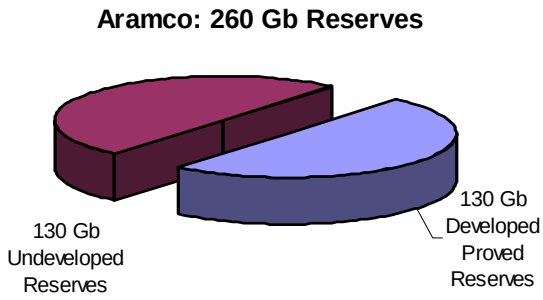
Total production in 50 years: 178 Gb

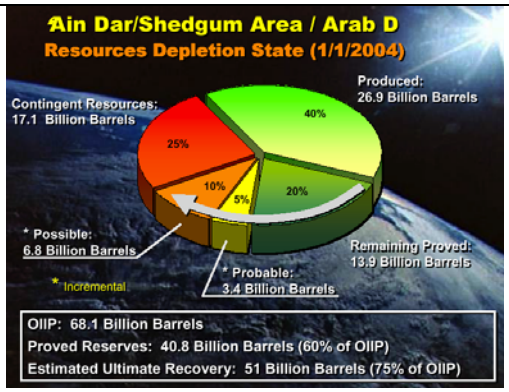


Total production in 50 years: 194 Gb

Apparently, the Saudis don't want to irreparably damage their fields by pushing them too hard. Compare this to the 22.5 mb/d for 2025 assumed in IEA's World Energy Outlook 2004.
A 2.5 mb/d increase would not even cover China's present import requirement of 2.85 mb/d.

2) Source: (http://www.csis.org/energy/040224_baqiandsaleni.pdf)

Saudi's contested oil reserves Dr. Sadad-Al-Husseini's article in the Oil & Gas Journal in May 2004	
Aramco excerpts: (Read several times to understand what's between the lines)	Remarks by ASPO
"As of 2004, Saudi Aramco has established its oil reserves at 260 billion barrels, which is approximately 25% of the world's proven oil reserves."	
"In terms of immediate [reserve] additions, the enhancements to conservative oil recoveries in undeveloped reservoirs will be more important than new field discoveries. Furthermore, if the past is any indication of the future, advances in technology are bound to reduce the cost of recovering marginal discovered resources, thus adding to the reserves figures. Given the fact that the discovered but undeveloped Saudi reservoirs make up about 130 billion barrels of the Kingdom's total reserves, the addition of new proven reserves through future reservoir developments is a foregone conclusion."	
"A 10% increase in recovery estimates for these reservoirs alone would generate 13 billion barrels of additional reserves. This is significant but clearly not sufficient to replace the high rates of Saudi production, currently averaging 3 billion barrels per year. On the other hand, at the current production rates and with an existing **reserves base of 260 billion barrels**, the issue of future reserves replacements will not be a concern until well beyond 2020."	Prof Aleklett from Uppsala University in Sweden comments: "**Reserves base is not proven reserves according to SEC, the Securities and Exchange Commission. That's the reason why Shell has to downgrade its reserves**" ASPO's Colin J Campbell[3)] notes: " [Husseini is] adding somewhat implausibly that there is an exactly equal amount of Undeveloped Reserves, which are evidently a good deal less than Proved. We may question exactly what is meant by the latter category. It may refer to unconfirmed new discoveries with extreme assumed recovery factors, or even oil-in-place."
"The supposed inability of Saudi Arabia to meet its production targets in the next few years also requires discussion. At the current depletion rate of 3 billion barrels per year, **which represents 2.3 % of the remaining 130 billion barrels of proven developed reserves**, this concern is debunked by simple mathematics."	Aramco's graph (left) illustrates what Campbell



means with his question. The EUR with 75% of oil in place is very high The depletion level would be: 40/(40+20+5)= 62%, not 40%.

produced	26.9	40%
remaining		
proved res.	13.9	20%
probable	3.4	5%
possible	6.8	10%
contingent	17.1	25%
oil in place	68.1	100%

The theoretical maximum of oil in place can never be produced fully. Only proved and probable reserves would be bankable.

Campbell summarizes: “On balance, the article does little to undermine ASPO’s evaluation, which considers only what will be produced prior to a cutoff in 2075 to avoid having to worry about the largely irrelevant tail end of production. Its current assessment is that 97 Gb have been produced so far; that 144 Gb will come from known fields and 18 Gb from new discovery, giving a total of 260 Gb, the number claimed as remaining reserves. **The article does little to counter ASPO’s current forecast that production will be flat to at least the midpoint of depletion in 2013. The depletion rate at that point would be about 2.3%,** which is still relatively low, meaning that plateau production could be extended for some years longer before terminal decline need set in.”

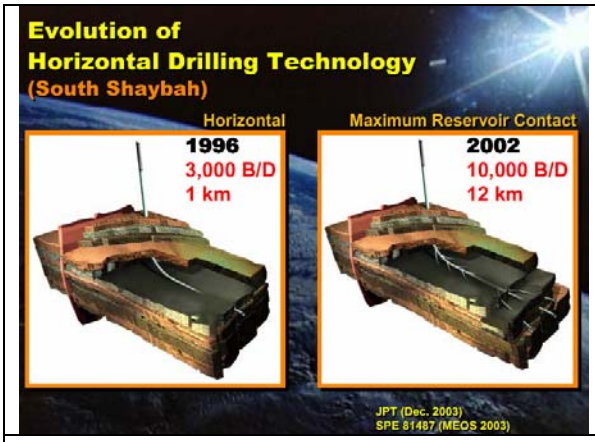
[3] Source: www.asponews.org June 2004

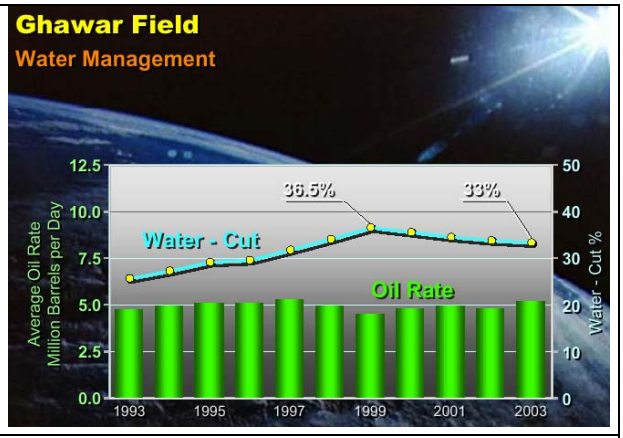
Saudi Arabian oil discoveries and production as estimated by ASPO

In his latest publication, “The truth of oil”, Eagle Print Ireland, Colin J. Campbell writes:

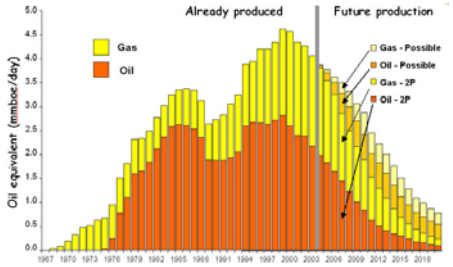
“Saudi Arabia granted a concession to a group of American companies in 1932, which led to the formal discovery of the World’s largest field Ghawar in 1948, although it had been virtually identified before, the Second World War interrupted operations. It stands head and shoulders above all the other discoveries, giving the overall peak.

Its reserve data is unreliable, having been also subject to the OPEC quota wars in the late 1980s. The scope for future discovery is limited because the size of fields outside the prolific Ghawar-Safaniya trend is quite modest. Production may also collapse sooner than expected because the water table in Ghawar is rising with the injection of 7 Mb/d of salt water. Multi-branch horizontal wells are now being drilled to tap by-passed low permeability zones in the difficult reservoirs where faults and fractures provide anomalous paths for the injected water to reach the wells. The Saudis themselves give much higher estimates.”



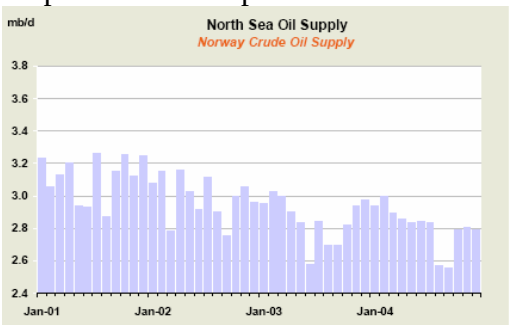


Multi-branch horizontal wells are needed to sweep oil from maturing oil fields in Saudi Arabia. 1/3 of fluid from the wells is already water. Source: Aramco[2)]

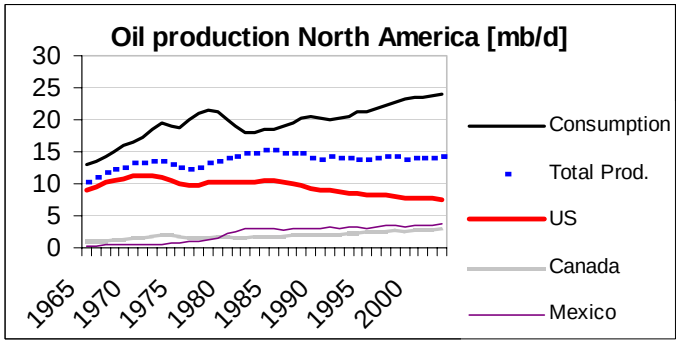


Source: ASPO

(1) UK's oil production peaked in 1999 (up, the dip is a result of the accident on the Alpha Piper platform), Norway's in 2002 (down). The total of the North Sea oil production has peaked.



Source: IEA monthly oil market report, 6/2004

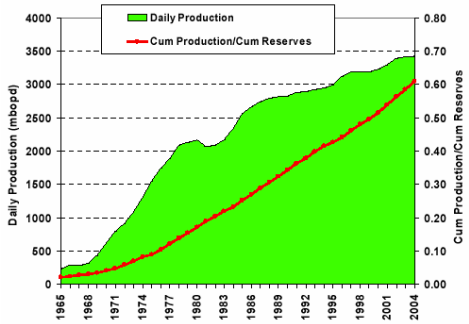


(2) North American oil production (US 48 + Alaska + Mexico + Canada) is on a 10 year long plateau; US 48 States peaked in 1970/71; the 2nd, lower peak in the mid 80s was from Alaska which is now producing at only half of its peak capacity. Producing oil from the Arctic National Wildlife Refuge (estimated total of 10.7 Gb equivalent to 1.5 years US consumption) would be just another small hump on an otherwise ever declining US production curve.

Canadian tar sands will require huge amounts of natural gas (which is also short in supply) for processing. The gap between consumption and production is widening, requiring increasing imports. This cannot go on for very long.

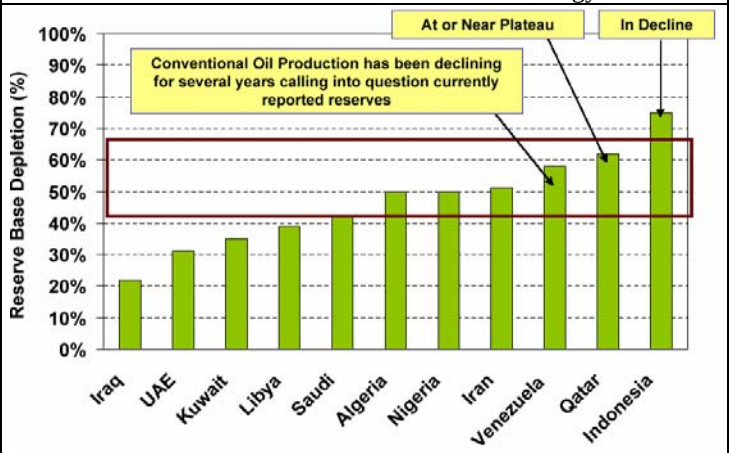
Source of data: BP Statistical Review of World Energy 2004

(3) China has consumed 60% of its oil and has now reached a plateau in production. Demand for oil in 2004 is expected to be 6.3 mill. barrels/day of which only 3.45 mb/d can be supplied from Chinese oil fields.



In just 3years, Chinese imports have doubled from 1.4 mb/d to 2.85 mb/d. China's future demand growth as well as the replacement for declining local production has therefore to be fully supplied from the world oil market.

Source: PFC Energy oil supply forecast 9/2004



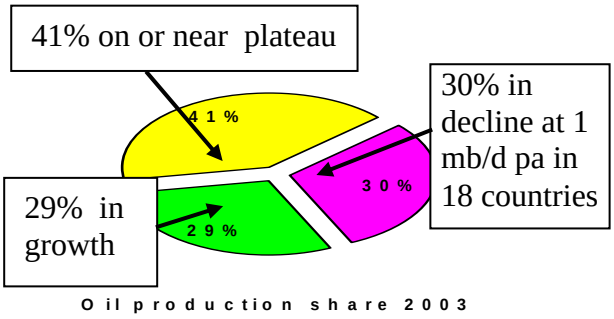
(4) Depletion levels in various OPEC countries. Saudi oil production is entering the critical plateau phase (highlighted box between 42%-68%) which should be of great concern. The further advanced technology extends the plateau towards higher depletion levels, the steeper the decline at the end of the plateau. Iraq's depletion level is low due to reduced production in the last 20 years (war with Iran and UN sanctions). There are still 30%-40% geologically easy pre-peak Iraqi oil. Source: PFC Energy oil supply forecast 9/2004

PFC Energy Oil Supply Forecast; www.csis.org/energy/040908_presentation.pdf
ASPO: Association for the Study of Peak Oil & Gas; www.peakoil.net and www.asponews.org
IEA: International Energy Agency, Paris; www.iea.org; BP: www.bp.com
Prepared by Matt Mushalik, last update 19/2/2005

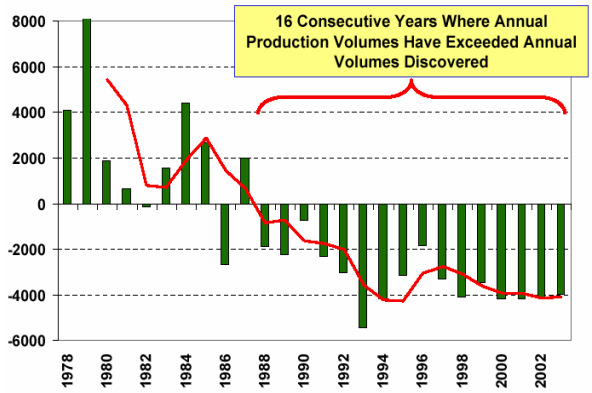
(5) Mounting evidence has appeared in the course of this year that some OPEC countries have been reporting total reserves ever discovered including past production instead of remaining reserves. Here are the differences between BP and 3 estimates where deductions have been made using various methods (in Gb):

Country	PFC	ASPO	Salameh	BP
Iraq	99	62	62	115
UAE	42	49	37	98
Kuwait	59	60	71	97
Saudi	134	144	182	263
Nigeria	23	25	20	34
Iran	54	60	64	131
Venezuela	34	35	31	78
Qatar	4.2	4.1	4.6	15
TOTAL	**450**	**440**	**472**	**831**

This means there could be around 350 Gb less oil than quoted by BP equal to 12 years world oil consumption or 32 years OPEC supply at current levels! This would destroy the myth of decades of cheap and plentiful oil supply from the Middle East.
http://www.asponews.org/docs/newsletter46.pdf

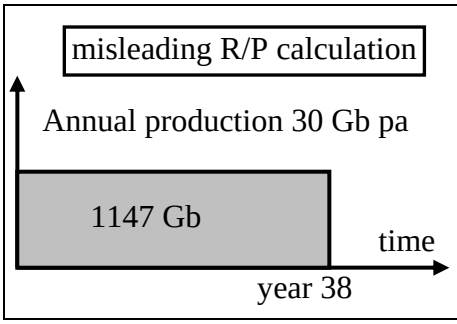


(8) An alarming 71% of the world's annual oil production is from countries with either stagnating or declining production. (BP data).



(6) For countries excluding Opec, FSU, Canada and NGLs, the annual balance between oil produced and discovered is negative for 16 consecutive years now. For every 4 liter consumed, only 1 liter is newly discovered.
Source: PFC Energy oil supply forecast 9/2004

(7) There are big question marks over the remaining reserves in Saudi Arabia's super giant oil field Ghawar, which started producing in 1948 and still contributes 5 mill barrels/day (=6% of world production). In 1975, Chevron reported 48 Gb as remaining reserves, but these were conservative estimates and ASPO rather assumes 80 Gb. By 2003, 53 Gb were produced, leaving 27 Gb and resulting in a depletion level of 65% - while Aramco claims it is 48%. Reservoir pressure in Ghawar can only be maintained by massive injection of (corrosive) saltwater. Total liquid produced already contains more than 30% water.
In any event, the IEA's monthly oil market report confirms that Saudi production growth in new projects can just offset decline in older fields (600-800 kb/d). Some analysts calculate that Saudi production will peak at 9.6 mb/d by end of 2004 and then decline to 8 mb/d by end 2007.



We usually divide remaining reserves by our annual production and think there are around 40 years of oil left. But we cannot simply distribute reserves evenly over any period of time to suit our current consumption. Oil geology does not work this way. Oil production always goes through a life cycle of growth, peak and decline. Future oil production must be properly computer simulated taking into account technical reserve data and current depletion levels (up, right, as done by ASPO). **The critical event in oil history is the peaking of production, not the ultimate "running out of oil" which may happen in 70-80 years or even later.**

Appendix 16: Analysis of International Energy Agency's WEO 2004 Table 3.5
Focus: OPEC's overstated reserves

Table 3.5: **World Oil Supply** (million barrels per day)

	2002	2010	2020	2030	2002-2030*
Non-OPEC	**45.3**	**51.3**	**47.9**	**43.4**	**-0.2**
OECD Total	**21.1**	**20.1**	**16.3**	**12.7**	**-1.8**
OECD North America	13.7	14.8	12.6	10.0	-1.1
United States and Canada	*10.1*	*10.6*	*8.7*	*7.2*	*-1.2*
Mexico	*3.6*	*4.2*	*4.0*	*2.8*	*-0.9*
OECD Europe	6.6	4.8	3.1	2.2	-3.9
OECD Pacific	0.8	0.5	0.5	0.5	-2.0
Transition economies	**9.5**	**14.6**	**15.4**	**15.9**	**1.8**
Russia	7.7	10.4	10.6	10.8	1.2
Other transition economies	1.9	4.2	4.7	5.2	3.7
Developing countries	**14.6**	**16.6**	**16.2**	**14.8**	**0.0**
China	3.4	3.3	2.7	2.2	-1.5
India	0.8	0.7	0.6	0.5	-1.6
Other Asia	1.7	1.6	1.2	0.6	-3.4
Latin America	3.7	4.7	5.5	6.1	1.8
Brazil	*1.5*	*2.5*	*3.3*	*4.0*	*3.6*
Other Latin America	*2.2*	*2.2*	*2.2*	*2.1*	*-0.2*
Africa	3.0	4.6	4.9	4.4	1.4
Middle East	2.1	1.8	1.4	1.0	-2.7
OPEC	**28.2**	**33.3**	**49.8**	**64.8**	**3.0**
OPEC Middle East	19.0	22.5	37.4	51.8	3.6
Other OPEC	9.2	10.7	12.4	13.0	1.2
Non-conventional oil	**1.6**	**3.8**	**6.5**	**10.1**	**6.7**
of which GTL	*0.0*	*0.4*	*1.5*	*2.4*	*16.0*
Processing gains	1.8	2.0	2.5	3.0	1.9
World	**77.0**	**90.4**	**106.7**	**121.3**	**1.6**

* Average annual growth rate.

The above table in billion barrels (Gb):

In Gb	2002-2010	2011-2020	2021-2030	2002-2030
Non OPEC Rest	63	78	77	218
North America	47	50	41	138
Europe	19	14	10	43
Russia	30	38	39	107
OPEC	101	152	209	462
Non Conventional	9	19	30	58
Process. Gains	6	8	10	24
Total				1050

World Energy Outlook's table 3.5 (left), which is being displayed as a graph on the next page, shows clearly that all growth in oil supplies comes from OPEC, with the exception of non-conventional oil, which contributes only modestly by comparison. The table implies that OPEC produces around 460 Gb in the period 2002 – 2030, a whopping 50% increase over current performance levels.

This is despite the fact that the IEA has, for the first time, calculated that OPEC added unexplainable reserves of 766-538=228 Gb between 1985 and 1990 and that several OPEC countries have peaked or are already in decline.

However, the IEA fails to reduce their reserve data by that amount and relies instead on the same USGS based table already used in the WEO 2001 (2.5 in 2001, now table 3.3), not changed by a single barrel. Table 3.5 would look quite different with reduced OPEC reserves.

IEA's annual supply in mill. barrels/day translates into a total of 1050 Gb (left) for a period of 29 years.

This is equal to the total reserve figure given by BP in 2003 and more than what the world has consumed in the last century!

Table 2.5: **USGS Estimates of Global Oil and NGL Resources** (billion barrels)

	Oil	NGL*	Total
Undiscovered recoverable resources	732	207	939
Mean reserve growth	688	42	730
Mean remaining reserves	891	68	959
Cumulative production	710	7	717
Ultimate recoverable resources	**3,021**	**324**	**3,345**

*NGL volumes for the US are included in the oil figures.
Note: World reserve and cumulative production data reflect only those parts of the world actually assessed.
Source: USGS (2000).

World Energy Outlook 2001 Table 2.5. Note that some of the resources would be of lower quality.

Table 3.3: **USGS Estimates of Ultimately Recoverable Oil and NGL Resources** (billion barrels)

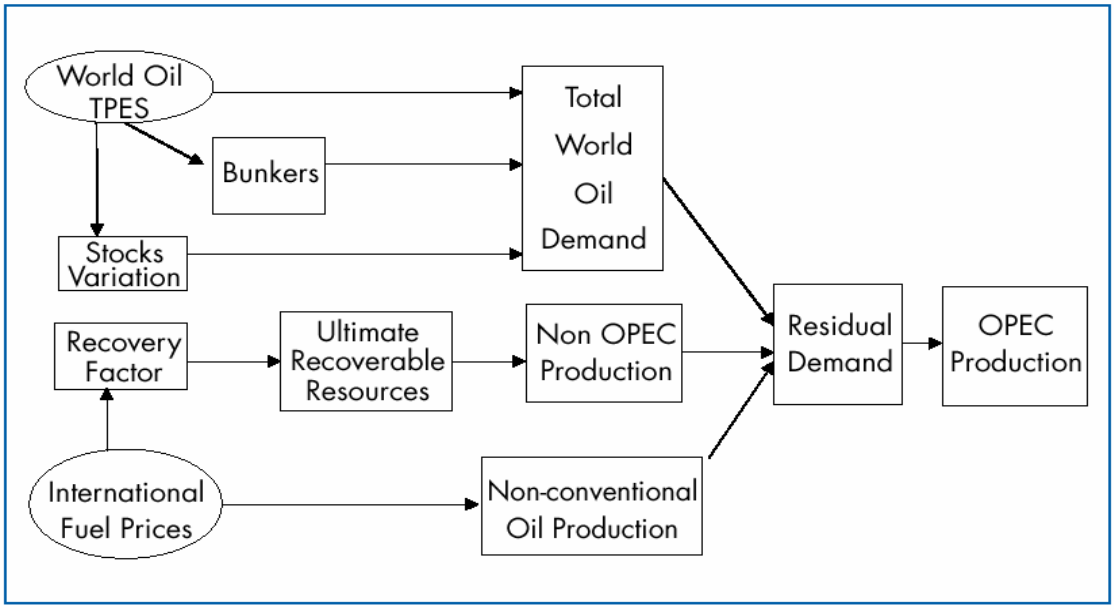
Category/probability*	95%	50%	5%	Mean
Undiscovered	495	881	1 589	939
Reserves growth	229	730	1 230	730
Remaining reserves				959
Cumulative production				717
Total ultimately recoverable resources				3 345
Remaining ultimately recoverable resources				**2 628**

* Per cent chance of there being at least the amount indicated.
Source: USGS (2000). Data are as of 1 January 1996 and for those parts of the world actually assessed.

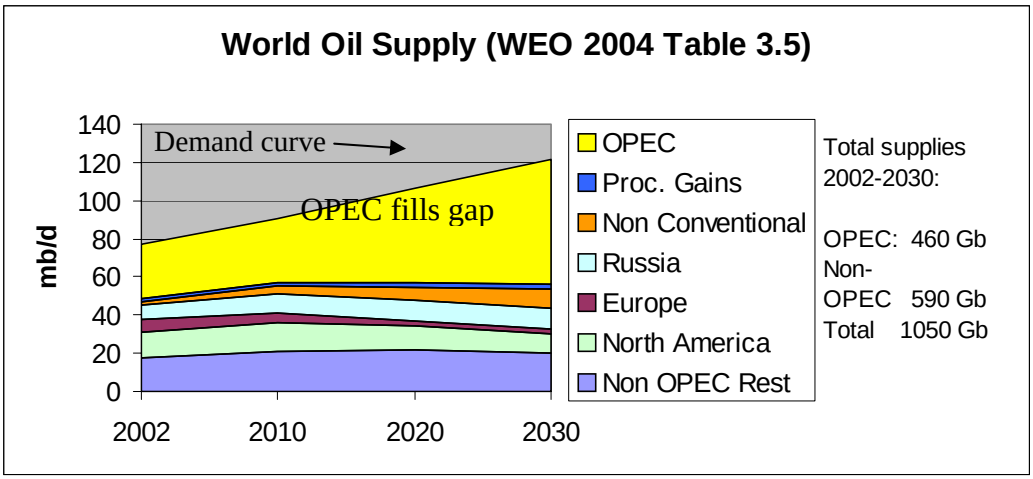
World Energy Outlook 2004 Table 3.3: unchanged despite overstated OPEC reserves.

- **Resources:** All oil theoretically thought to be present in an area (oil geologist's opinion). Costs of accessing resources are unknown. Bankers will not loan money on resources.
- **Reserves:** Oil that has been discovered and is expected to be economically producible (oil engineer's conservative opinion). Bankers will loan money on reserves.

Figure A1.6: **Structure of Oil Supply Module**



Oil supply methodology applied in WEO 2001 (up), in which OPEC production is calculated as the difference between demand and Non-OPEC plus Non-conventional production.



The same method seems to have been used in WEO 2004 again. Table 3.5 entered in a spreadsheet and displayed using the graphics tool (up) clearly shows growing OPEC production against a flat or slightly decreasing rest production. Therefore:

But can OPEC really deliver 460 Gb in the next 3 decades? During the last 10 years, OPEC achieved approximately 11 Gb per annum, which would be 320 Gb in 29 years. The growth element in the above graph is 235Gb>228Gb which IEA mentions is OPEC's overstated reserve figure. In other words:

The above formula (=swing role) may have worked in the past, but as several OPEC countries are approaching a plateau in production, this should no longer be taken for granted.

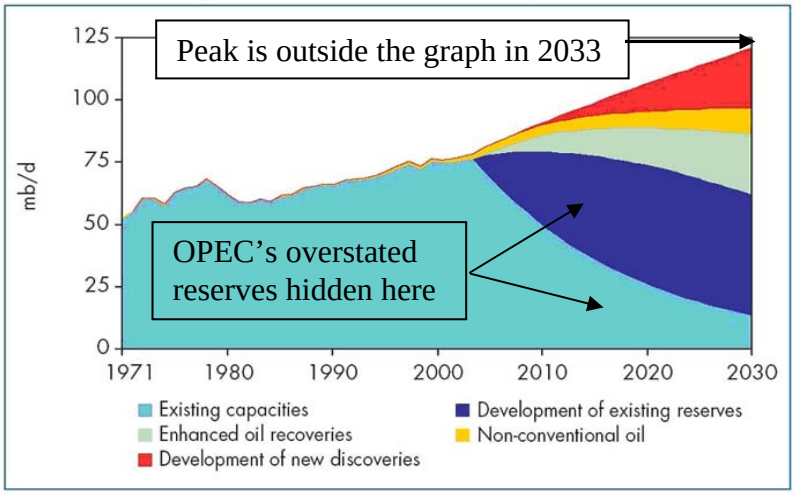


Figure 3.20 in WEO 2004 showing future production as in the previous graph on page 2 but here detailing different types of oil categories. The peak in 2033 is not shown.

Oil supplies in Gb 2002 to 2030

New discoveries	90
Non-conventional oil	60
Enhanced oil recoveries	120
Development of existing reserves	370
Existing capacities	410
Total	1050

The numbers in the above table represent the areas in the graph of figure 3.20 (left). It is surprising that less than 10% is from new discoveries.

The graph shows:

(1) Production from existing capacities rapidly declines between 3 and 5 % pa from 75 mb/d in 2003 to just 15 mb/d in 2030 meaning that ever increasing amounts of oil would have to come from new capacities just to hold the status quo.

(2) Existing capacities and existing reserves would peak around 2010, and then decline at 1-2% pa. Note that OPEC's overstated reserves have not been deducted.

(3) Therefore, growth would only come from enhanced oil recovery, non-conventional oil and new discoveries. These new discoveries alone (25 mb/d in 2030) would require to develop 4 new oil provinces the size of the North Sea (peak production 6 mb/d)

Prof. Aleklett from Uppsala University has prepared a 17 page long commentary on WEO 2004 entitled "IEA accepts peak oil". He says one needs to decode the hidden messages in some of IEA's statements:

- "Production of conventional oil will not peak before 2030 **if the necessary investments are made**"
- But the "peak of production would come by 2015 or before if the USGS mean estimate should prove too high"

Other main points made in ASPO's critique are:

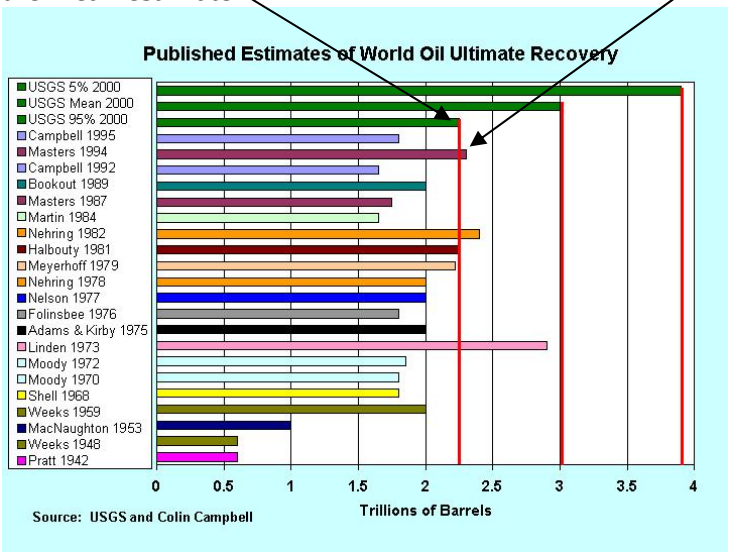
- The IEA's political agenda does not allow oil production to decline
- There is a steady trend of falling annual oil discovery rates since the 1960s
- Drilling more will not substantially yield much higher reserves as shown in creaming curves
- OPEC's spurious reserve additions in the 1980s have been acknowledged by the IEA
- The IEA fails to draw conclusions from the above and turns to the flawed USGS 2000 study by adopting their mean estimate which is much higher than the consensus of 65 studies over the last 30-40 years
- Reserve growth, assumed by the IEA to be one of the most important providers of additional oil, will affect production mainly after peak oil
- Russia's oil exports have been over-estimated
- The IEA did not consult the (expensive) Industry Database held by IHS
- Saudi Arabia's publicly declared intention to limit production to 12 mb/d as a maximum sustainable capacity will not allow OPEC production to grow as IEA assumes

For more details, see Prof. Aleklett's analysis of chapter 3 at www.peakoil.net

The overstated OPEC reserves have another effect on the USGS 2000 mean estimate: the reserve growth element would also have to be reduced.

The USGS 2000 team had, compared to its 1994 estimate, added a new category of oil called **'reserve growth'**. This is a reserve reporting phenomenon found in America where early, conservative estimates ("proved reserves") according to SEC rules were later consecutively revised upwards as reserve categories "probable" and "possible" were developed and produced. Only 6% of US reserve additions over the past 20 years came from new discoveries. The growth factor based on US experience was found to be 44%. This percentage was then applied to the known fields of the rest of the world, though reserve reporting is different there.

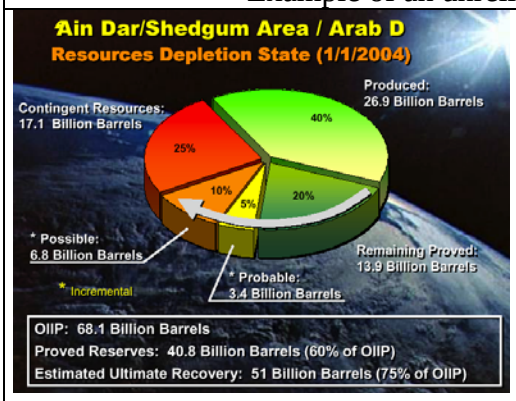
The USGS 95% probable estimate should be used, not the mean estimate



Source: www.eia.org

The USGS 1994 estimate by C.D. Masters had rejected the idea of such a reserve growth for the rest of the world by noting that many other countries, in particular all OPEC countries, the former Sowjet Union, China and Mexico are reporting proved + probable + possible reserves thereby already including future reserve growth. The amount in question is huge: 612 Gb equal to 20 years of current global oil production. According to the USGS 2000 team itself, these reserves are "preliminary" and "hypothetical", requiring further research, which has not been done yet.

Example of an unreliable USGS reserve growth calculation



Let's have a look at this Saudi oil field (left).

oil category	Gb	
produced	26.9	40%
remaining		
proved res.	13.9	20%
probable	3.4	5%
possible	6.8	10%
contingent	17.1	25%
oil in place	68.1	100%

The actual reserve growth would be 'probable' + 'possible':

3.4 + 6.8 =10.2 Gb

or 10.2/(26.9+13.9)=25%
of past production and remaining reserves.

Using the USGS method, the calculation would be: (26.9+13.9) x .44=18 Gb or 80% more than actually available. Since the OPEC reserve reporting is not clear, there are 2 more possibilities:

(a) If the Saudis include 'probable' and 'possible' in their published reserves , the USGS reserve growth calculation would be: 51 x .44 = 22 Gb

(b) If the Saudis report total reserves ever found instead of remaining reserves, the USGS formula would yield: (40.8+26.9) x .44 = 30 Gb.

This means that the USGS mean estimate of reserve growth may be up to 3 times the physically available oil. Why would any bank accept these speculative figures as a basis for multi billion dollar decisions in oil dependent infrastructure?

Source of graph: www.csis.org/energy/040224_baqiandsaleni.pdf