Submission to the Cabinet Office *Energy Review*

by

The Oil Depletion Analysis Centre

Abstract

The world faces severe hydrocarbon supply difficulties:

- Global oil supply is currently at *political* risk. This is because the sum of conventional oil production from all countries in the world, except the five main Middle-East suppliers, is more-or-less at the maximum set by physical resource limits.
- World oil supply will soon be at *physical* risk. This is because the Middle-East countries have themselves little spare operational capacity, and this will be increasingly called upon as oil production declines elsewhere.
- Large investments in Middle-East production, if they occur, could raise output, but only to a limited extent. The main exception is Iraq, but even here there would be significant delays before prospects are confirmed, and infrastructure put in place.
- In any event, global output of conventional oil will soon decline. The date of the peak depends on the size of Middle East reserves, which are poorly known, and unreliably reported. Best estimates put the global conventional oil peak between five and ten years away.
- The world contains large quantities of non-conventional oil and various oil substitutes, but the rapid decline in the output of conventional oil makes it unlikely that non-conventional sources could come on-stream fast enough to compensate.
- For conventional gas, the world's original endowment is probably about the same, in energy terms, as its endowment of conventional oil. Since less gas has been used so far compared to oil, the world will turn increasingly to gas as oil declines. But the global peak in conventional gas production is already in sight, in perhaps 20 years, and hence the global peak of all-hydrocarbons (oil plus gas) is likely to be in about 10 years.

The above assessments are based on extensive geological knowledge, statistical approaches to assessing the yet-to-find, and access to the standard industry oil and gas resource database. Given the seriousness of these findings, we would encourage the Energy Review to carry out, or commission, the relatively straightforward work of checking these calculations.

1. World Oil Supply

1.1 The current situation

The US went over its resource-limited peak in oil production in 1971, and US oil output has been declining since.

The peak in US production had global consequences. At that date, world oil supply came almost entirely from the US, OPEC and Russia. With US supply in decline, and Russian oil largely confined to the communist world, the marginal barrel had to be supplied by OPEC. Thus the world's oil supply was at the mercy of political decisions

within OPEC, with the Yom Kippur war triggering the first oil shock and the Iranian revolution the second. The combined effect of these shocks pushed the world into a long and deep recession, and led to a wide range of other effects.

The present situation has important similarities. Now it is oil supply from all countries of the world, except the five Middle-East members of OPEC, that is more-or-less at its resource-limited peak. It is this limit to non-OPEC supply that allows the current OPEC quotas to be effective. Once again, as in the 1970's, the marginal barrel has to be supplied by OPEC, and the world's oil supply is at political risk.

This time, however, the Middle-East producers are themselves severely constrained. They have significant domestic budgets, so have an incentive to sell their oil, but they also, this time, face resource constraints of their own. There is currently little Middle-East spare operational capacity, and this will be eaten into as conventional oil elsewhere declines. Saudi Arabia, for example is already working hard to maintain output from its old large fields. Increased investment, if thought justified by the countries concerned, would certainly boost production for a while; but it is probably largely only in Iraq that significant prospects, identified before sequestration, exist to be brought on stream

Thus the purely 'political-risk' phase does not last for long, and is replaced by physical shortages if large investments in Middle East production are not made. And even if these investments are made, underlying resource limits mean that total world supply of *conventional* oil, including that from the Middle-East producers, goes into decline fairly soon. The date of this decline depends critically on how much oil there is in the Middle-East countries, a quantity that is not well known. On our estimates, the date for this decline is about 5 years away; others assume more optimistic values for the Middle-East oil endowment, and put the global decline up to 15 years away.

The effects of a decline in conventional oil supply are complicated by uncertainties about the rate that oil recovery factors can improve (giving 'enhanced recovery' oil); and the amount of supplies that may become available from non-conventional oils (heavy oils, tar sands and shale oils), and from other non-conventional liquids (gas-to-gasolines, oil from coal, biofuels etc.).

But the rate of decline of conventional oil will be steep, a fall of the order of 2 million barrels per day (Mb/d) each year. And, if current world demand is to be satisfied, an annual increase in the supply of petroleum liquids of roughly the same magnitude is required. That is, the combined output from enhanced recovery and the non-conventionals must increase by something like 4 Mb/d each year if the existing demand trend is to be satisfied.

This size of annual increase looks very unlikely. Various studies indicate that the amount of extra oil that can be made available by enhanced oil recovery, certainly within any timescale that affects global peaking, will be rather small. And on the non-conventionals, though more analysis is required, it would seem that the driving factors (including technological readiness, energy content, investment limits, water requirement, and emissions of CO_2 and other pollutants), all act to limit the rate these will come on-stream.

1.2. Modelling world oil supply

The 1971 US peak had been predicted by US geologist M. King Hubbert by combining estimates for the total amount of US (lower-48) oil with the resource 'logistic' curve. (The latter indicates that supply peaks when about half the recoverable resource has been extracted). Though applied to the lower-48 states, this approach correctly captured the all-US peak, despite the US having made its biggest single find, Prudhoe Bay, only just before the peak; and despite the current finds in the deepwater Gulf of Mexico. The success of this approach is not surprising when one considers that production has to largely mirror the original discovery trend (see, e.g., recent work by Laherrère [1]), and that the peak in the US discovery trend was back in the 1930's.

This forecasting technique was applied by a range of competent authorities, at various dates during the 1970's and early 1980's, to calculate the date for the peak in the world conventional production. These authorities included the UK Dept. of Energy, Esso, Shell and the World Bank. All used estimates for the world's original endowment of conventional oil lying somewhere in the region of 2,000 billion barrels (Gb), and hence calculated that the world conventional oil peak would occur around the year 2000.

If *statistical* methods are used to estimate this original endowment of conventional oil, such estimates have changed little over the last 30 or 40 years, and still stand today at about 2,000 Gb, once NGL's are taken out; see for example [2]. So the same calculation done today gives essentially the same prediction, but with the date of peak shifted to compensate for the reduction in global demand following the 1970's oil shocks.

A group of petroleum geologists, engineers and physicists at the University of Reading (including the author of this submission) examined this oil forecasting technique in some depth. We concluded that it is reasonably accurate and robust to uncertainties; see references [3] to [6]. (Note that the Energy Review's questioning of the credibility of oil past forecasts [Ref. 7] needs to be set against these findings; in assessing past forecast one needs to understand both the assumptions that were made, and the data that were used.)

Unfortunately, the 'logistic curve' method of modelling the future of oil supply got largely forgotten during the later 1980's and 1990's.

In this period, the IEA, the EU, the US EIA, and many in industry, fell into the trap of looking at the global oil 'reserves-to-production' ratio (R/P ratio) to provide a measure of the security of oil supply. Since this ratio indicates that current oil reserves are enough to provide 40 years' of supply, and since more oil will certainly be found, this naïve analysis seems to push any risk of oil supply difficulties out to 50 or more years in the future.

This 'R/P view' of the world's oil still largely dominates. Recently, however, a few bodies, such as the IEA, and more recently still, the US' EIA and the EU, have begun to understand the need to use the logistic curve for modelling future oil supply.

But, essentially because of inexperience, many errors still exist. The US' EIA, for example, drives its decline curves from spurious 'fixed R/P' ratios; while the IEA has used inappropriate US Geological Survey data. We believe that the IEA may currently be re-evaluating its forecasting procedures, and await the outcome.

Table 1 presents our current estimates of world conventional oil endowment, by country. (For analytical reasons, this table excludes polar and deepwater oil).

These estimates are based on geological knowledge, statistical approaches to assessing yet-to-find, and access to the standard industry oil and gas resource database. These numbers lead to the conclusions set out earlier. We would encourage the Energy Review to carry out, or commission, the relatively straightforward work of checking these assessments.

(Note that where others present different numbers, it would be useful to explain how the latter are derived.)

Table 2 gives our current estimates of total oil production, including that from polar, deepwater and non-conventional sources. The latter have a fair degree of uncertainty, but overall represents what we think is a realistic forecast of what is possible. Again, we would encourage the Energy Review to check these estimates.

2. UK Oil Supply

We regret to say that in our view the UK government seems to have had, at least until recently, only a rather poor understanding of UK future oil production. For example, recent 'Brown Books' made no mention of the near-term production peak, and noted only that more fields than ever before were in production. The fact that these new fields are very small, and will last just a few years, was not drawn to the readers' attention.

This lack of detailed understanding is born out by the very wide range of estimates for UK recoverable oil resources, as given in [Ref. 7]. While the ends of this range can, of course, be numerically justified from particular viewpoints, any attempt to know what is *likely* to happen has to take a more pragmatic view. Probably such a wide range can be traced, in part, to the more general industry confusion over whether it needs to report proved or (proved + probable) reserves; and to a long-term lack of research within the DTI's Oil & Gas Directorate concerning either UK or global future oil production.

Whatever the background, there is clearly a current need for the Energy Review to properly understand:

- Near-term N. Sea oil production potential.
- WoS. & Atlantic prospects, vs. timing.
- The potential for enhanced oil recovery if global oil supply is disrupted.
- The commercial cut-offs as they apply to small fields (the 'Skrebowski effect').

3. World Gas Supply

Whereas most exploration geologists, with a global view, agree that for oil the current find rate trends are unlikely to change, there is not such a consensus about gas. Some geologists feel that, since they have 'not been looking for gas', there will be a lot more to find once the effort is put in. The counter-argument is that, though there are likely to be large new gas finds, in N. Russia for example, over the last 30 years or so the total estimate for the world's original endowment of natural gas has changed little [2].

Our best view at present is that the current estimates of the original endowment of conventional gas, at about 10,000 Tcf, are correct. On this basis, though mankind is further from the peak point for global gas than for global oil, the end for conventional gas is already in sight: mankind has probably burned about half the gas needed to take us to the world production peak of conventional gas.

For gas also, therefore, the Energy Review should consider carrying out, or commissioning, global modelling. (Note that the methodologies to study future gas profiles are not as well defined, within academic or industry circles, as for oil, and will require additional research.) The current experience from the US suggests that when a gas decline does set in, it is very steep, reflecting gas's high molecular mobility.

4. Decision-Making Structure for an Energy Policy for Britain

During the last oil shocks, the experience of the world's ability to understand what was happening, and to take sensible decisions, largely told a sorry tale. Hubbert's forecast had been ignored, as had similar calculations by others, see, e.g., [Ref .8]. Fundamentally, there was no adequate mechanism within society to consider the information that was available.

The UK currently has at least four initiatives on future energy supply: the current Cabinet Office Energy Review, looking out 50 years; one within the DTI and Ofgem on nearer-term energy security; one by the House of Lords considering the EU's recent Green Paper on Security of Energy Supply; and one, we are told, within the House of Commons.

But the issues are complex, and the task is perhaps like building a bridge or designing a 'plane. It will need the concentrated effort of a wide range of technically competent people to work solidly on the issues; and require more, in our view, than the output from relatively small groups of people who can, mostly, only canvas opinion. The latter is important, but is only a first step.

Given the magnitude of the coming energy supply problems, the Energy Review might do well to help structure an 'Energy Board' of sufficient qualification, and with an adequate remit.

References

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The Oil Depletion Analysis Centre aims to supply independent information on global hydrocarbon resources. The Centre has applied for charitable educational status.

TABLE 1:

SUMMARY: CONVENTIONAL OIL ENDOWMENT (Excludes Polar and Deeppwater oil) End-2000 data

	PRODUCTION		**RESERVES**										
		Cum.	Reported				**Asse-**	DISCOV-	**YET-**			DATES	
	kb/d	**Prod.**	World	O&GJ	Adjust	Factor	**ssed**	ERED	**TO-**		Dep.	MP	Peak
Country	2000	Gb	Oil		+/-				**FIND**	**ULT.**	Rate	Dep	Prod
Saudi Arabia	8064	**88.9**	259.10	259.20	0.00	0.60	**155.5**	244.4	**15.57**	**260**	1.7%	2011	**2011**
Russia	6351	**119.0**	52.66	48.57	-2.32	1.3	**60.1**	179.1	**20.91**	**200**	2.8%	1992	**1987**
USA-48	4096	**167.1**	19.63	21.76	-9.00	1.5	**19.1**	186.2	**3.77**	**190**	6.1%	1970	**1971**
Iraq	2681	**25.9**	100.00	112.50	-2.67	0.85	**93.4**	119.2	**15.79**	**135**	0.9%	2020	**2011**
Iran	3568	**51.7**	93.10	89.70	-2.58	0.75	**65.3**	117.1	**7.94**	**125**	1.7%	2007	**1974**
Venezuela	2580	**44.5**	47.1	76.9	-30.00	0.9	**42.2**	86.7	**8.3**	**95**	1.8%	2003	**1968**
Kuwait	1774	**29.6**	92.40	94.00	-5.49	0.55	**48.7**	78.3	**6.70**	**85**	1.2%	2011	**2011**
Abu Dhabi	1850	**16.7**	62.50	92.20	-6.77	0.65	**55.5**	72.2	**4.76**	**77**	1.1%	2019	**2012**
Mexico	3050	**27.7**	28.3	28.3	0.00	1.0	**26.8**	54.5	**2.5**	**57**	3.7%	2001	**2001**
China	3255	**26.1**	34.1	24.0	-12.15	2.0	**23.7**	49.8	**5.2**	**55**	4.0%	2001	**2001**
Libya	1408	**21.9**	29.5	29.5	-1.51	0.9	**23.8**	45.7	**2.3**	**48**	1.9%	2004	**1978**
Nigeria	1991	**20.9**	24.5	22.5	-2.44	1.3	**25.1**	46.0	**2.0**	**48**	2.6%	2004	**2004**
Kazakhstan	627	**5.40**	6.42	5.42	-0.23	5.0	**10.4**	15.8	**24.23**	**40**	0.7%	2027	**2032**
Norway	3216	**14.0**	10.0	9.4	0.00	1.5	**14.2**	28.1	**1.9**	**30**	6.8%	2001	**2001**
U.K.	2537	**18.0**	5.0	5.0	0.00	2.0	**10.0**	28.0	**1.0**	**29**	7.7%	1996	**1999**
Indonesia	1299	**19.0**	8.4	5.0	-2.97	4.0	**8.02**	27.0	**1.0**	**28**	5.0%	1990	**1977**
Canada	1100	**18.0**	5.6	4.7	0.00	1.6	**7.53**	25.5	**1.5**	**27**	5.7%	1989	**1973**
Algeria	800	**11.5**	13.0	9.2	-2.58	2.0	**13.2**	24.8	**1.7**	**26.50**	1.9%	2005	**1978**
Azerbaijan	258	**7.89**	0.00	1.18	-0.09	5.0	**5.42**	13.3	**1.69**	**15.00**	1.3%	1995	**2005**
Qatar	681	**6.3**	5.4	13.2	0.00	0.7	**9.21**	15.5	**0.5**	**16.00**	2.5%	2006	**2006**
N.Zone	628	**6.22**	4.65	5.00	-1.61	2.00	**6.77**	13.0	**1.00**	**14.00**	2.9%	2003	**2003**
Oman	891	**6.3**	5.7	5.5	0.00	1.2	**6.61**	12.9	**0.9**	**13.75**	4.2%	2002	**2002**
Egypt	811	**8.1**	3.8	2.9	-0.30	1.5	**3.98**	12.1	**0.6**	**12.75**	6.0%	1994	**1994**
Argentina	749	**7.7**	2.6	3.0	0.00	1.0	**2.89**	10.6	**0.4**	**11.00**	7.7%	1992	**1998**
India	639	**5.1**	3.4	4.7	0.00	1.1	**4.96**	10.1	**0.7**	**10.75**	4.0%	2001	**2001**
Colombia	689	**5.3**	2.3	2.6	-0.55	2.0	**4.06**	9.4	**1.1**	**10.50**	4.6%	2000	**1999**
Angola	744	**4.0**	8.5	5.4	-4.21	5.0	**6.01**	10.0	**0.5**	**10.50**	4.0%	2003	**2003**
Australia	720	**5.3**	2.9	2.9	-0.46	1.2	**1.55**	8.25	**0.50**	**8.75**	7.1%	1995	**2000**
Malaysia	671	**4.8**	4.6	3.9	-0.77	0.9	**2.82**	7.57	**0.43**	**8.00**	7.0%	1997	**1999**
Brasil	413	**4.3**	8.1	8.1	-9.00	-3.0	**2.70**	6.97	**0.53**	**7.50**	4.4%	1997	**1985**
Romania	123	**5.7**	1.2	1.4	-0.09	0.9	**1.20**	6.87	**0.63**	**7.50**	2.4%	1973	**1976**
Ecuador	390	**3.0**	3.0	2.1	-0.70	3.0	**4.25**	7.24	**0.26**	**7.50**	3.1%	2005	**2005**
Turkmenistan	143	**2.8**	-	0.5	-0.05	4.0	**1.98**	4.79	**1.21**	**6.00**	1.6%	2003	**1973**
Syria	510	**3.4**	2.3	2.5	-1.23	1.2	**1.53**	4.94	**0.56**	**5.50**	8.2%	1997	**1995**
Dubai	333	**3.6**	1.0	4.0	-1.53	0.4	**0.99**	4.55	**0.20**	**4.75**	9.3%	1990	**1991**
Brunei	169	**2.9**	1.0	1.4	-0.58	2.0	**1.55**	4.41	**0.09**	**4.50**	3.6%	1987	**1978**
Gabon	331	**2.6**	2.6	2.5	-1.37	1.2	**1.35**	4.00	**0.25**	**4.25**	7.0%	1996	**1996**
Peru	97	**2.3**	4.1	0.3	0.00	5.0	**1.55**	3.81	**0.19**	**4.00**	2.0%	1994	**1983**
Ukraine	48	**2.6**	-	0.4	0.02	1.2	**0.49**	3.09	**0.91**	**4.00**	1.2%	1983	**1970**
Trinidad	120	**3.1**	0.7	0.7	0.00	1.0	**0.69**	3.80	**0.20**	**4.00**	4.7%	1980	**1978**
Yemen	441	**1.4**	2.1	4.0	-1.25	0.5	**1.37**	2.77	**0.48**	**3.25**	8.0%	2001	**2001**
Uzbekistan	152	**0.9**	-	0.6	-0.06	2.5	**1.35**	2.29	**0.71**	**3.00**	2.6%	2008	**2008**
Congo	265	**1.3**	1.7	1.5	-0.51	1.5	**1.49**	2.82	**0.18**	**3.00**	5.5%	2002	**2002**
Vietnam	304	**0.7**	1.8	0.6	-0.29	5.0	**1.56**	2.22	**0.53**	**2.75**	5.0%	2005	**2005**
Denmark	357	**1.1**	0.9	1.1	-0.13	1.1	**1.03**	2.10	**0.40**	**2.50**	8.3%	2001	**2001**
Germany	61	**1.9**	0.3	0.4	0.00	1.0	**0.38**	2.26	**0.14**	**2.40**	4.1%	1976	**1967**
Tunisia	75	**1.1**	0.3	0.3	-0.06	2.6	**0.65**	1.80	**0.20**	**2.00**	3.1%	1995	**1995**
Italy	92	**0.8**	0.6	0.6	-0.07	1.8	**0.99**	1.81	**0.19**	**2.00**	2.8%	2005	**2005**

Thailand	110	**0.3**	0.3	0.4	0.00	2.5	**0.88**	1.21	**0.29**	**1.50**	3.3%	2008	**2008**
Cameroon	101	**1.0**	0.6	0.4	-0.61	-1.5	**0.32**	1.31	**0.19**	**1.50**	6.7%	1994	**1986**
Bahrain	102	**1.2**	-	0.1	-0.04	1.0	**0.11**	1.27	**0.23**	**1.50**	9.8%	1985	**1993**
Turkey	57	**0.8**	-	0.3	0.00	0.8	**0.24**	1.03	**0.17**	**1.20**	4.8%	1992	**1991**
Hungary	27	**0.7**	0.1	0.1	-0.01	0.9	**0.09**	0.78	**0.22**	**1.00**	3.1%	1986	**1994**
Sharjah	45	**0.4**	-	1.5	-0.19	0.3	**0.39**	0.83	**0.17**	**1.00**	2.8%	2003	**1997**
Croatia	23	**0.5**	0.0	0.1	-0.01	4.0	**0.33**	0.81	**0.19**	**1.00**	1.6%	2003	**1977**
Netherlands	51	**0.8**	0.1	0.1	-0.02	1.4	**0.12**	0.93	**0.07**	**1.00**	8.8%	1987	**1989**
Austria	20	**0.8**	0.1	0.1	-0.01	1.3	**0.10**	0.87	**0.08**	**0.95**	3.8%	1971	**1955**
France	29	**0.7**	0.2	0.1	0.00	1.2	**0.17**	0.88	**0.07**	**0.95**	4.1%	1987	**1988**
Papua	69	**0.3**	0.0	0.4	-0.06	1.3	**0.39**	0.70	**0.20**	**0.90**	4.0%	2005	**1993**
Bolivia	34	**0.4**	0.2	0.4	0.00	0.6	**0.24**	0.64	**0.16**	**0.80**	3.0%	2000	**1974**
Albania	6	**0.5**	-	0.2	-0.04	1.2	**0.15**	0.68	**0.12**	**0.80**	0.8%	1986	**1983**
Pakistan	55	**0.3**	0.2	0.2	-0.08	1.3	**0.17**	0.59	**0.16**	**0.75**	5.7%	1998	**1992**
Philippines	1	**0.0**	0.0	0.3	0.00	1.2	**0.35**	0.39	**0.21**	**0.60**	0.1%	2013	**2013**
Chile	9	**0.4**	0.1	0.2	-0.01	0.3	**0.04**	0.46	**0.04**	**0.50**	3.7%	1979	**1982**
REGIONS													
ME Gulf	18565	**219.0**	611.75	652.60	-19.13	0.67	**425.2**	644.2	**51.8**	**696**	1.4%	2013	**2011**
Eurasia	11012	**172.1**	94.46	82.49	-15.02	1.56	**105.2**	277.3	**56.0**	**333**	2.4%	1999	**1987**
N.America	5196	**185.1**	25.20	26.47	-9.00	1.53	**26.7**	277.3	**56.0**	**217**	5.6%	1972	**1972**
L.America	8131	**96.6**	96.48	122.50	-40.26	1.04	**85.4**	182.0	**15.8**	**198**	2.8%	2001	**1998**
Africa	6524	**72.6**	84.37	74.27	-13.60	1.25	**75.9**	148.5	**8.0**	**157**	2.8%	2002	**2004**
W.Europe	6363	**38.0**	17.19	16.86	-0.23	1.62	**27.0**	65.0	**3.8**	**69**	7.0%	1998	**2000**
Far East	4035	**38.8**	22.57	19.66	-5.20	1.63	**23.6**	62.4	**4.1**	**67**	5.0%	1997	**2000**
ME.Other	3060	**23.3**	16.50	31.11	-4.24	0.76	**20.4**	43.8	**3.2**	**47**	4.5%	2000	**2000**
Other	347	**3.3**	0.00	0.00	0.00	0.00	**7.7**	10.9	**1.1**	**12**			
Unforeseen									**5.2**	**5.2**			
Non-Swing	44725	**630**	357	373	-88	1.3	**372**	1002	**102**	**1104**	3.3%	1997	**1998**
WORLD	63290	**849**	969	1026	-107	0.9	**797**	**1646**	**154**	**1800**	2.4%	2002	**2003**

TABLE 2:

RESOURCE-BASED PRODUCTION FORECAST

Conventional Oil - Base Case Scenario				
kb/d	**2000**	**2005**	**2010**	**2020**
Saudi Arabia	8064	9800	11374	8590
Russia	6351	5516	4790	3613
USA-48	4096	2986	2177	1157
Iraq	2681	4452	7366	5714
Iran	3568	3958	5124	3975
Venezuela	2580	2854	2547	2028
Kuwait	1774	2968	3843	2981
Abu Dhabi	1850	2815	3678	3085
Mexico	3050	2722	2220	1478
China	3255	2864	2297	1476
Libya	1408	1667	1464	1130
Nigeria	1991	2333	1945	1351
Kazakhstan	627	924	1235	1926
Norway	3216	2344	1609	758
U.K.	2537	1696	1133	506
Indonesia	1299	1005	778	466
Canada	1100	885	712	461
Algeria	800	1021	889	674
Azerbaijan	258	415	370	293
Qatar	681	869	774	514
N.Zone	628	742	641	497
Oman	891	841	650	388
Egypt	811	595	436	235
Argentina	749	503	337	152
India	639	554	444	285
Colombia	689	544	429	267
Angola	744	771	586	357
Australia	720	498	344	165
Malaysia	671	466	324	157
Brasil	413	329	262	166
Romania	123	109	96	76
Ecuador	390	498	391	242
Turkmenistan	143	138	127	107
Syria	510	333	217	92
Dubai	333	205	126	48
Brunei	169	140	117	81
Gabon	331	230	160	77
Peru	97	88	79	65
Ukraine	48	45	42	37
Trinidad	120	94	74	46
Yemen	441	316	196	76
Uzbekistan	152	194	202	118
Congo	265	237	166	82
Vietnam	304	387	243	95
Denmark	357	251	152	56
Germany	61	49	40	26
Tunisia	75	64	54	40
Italy	92	117	95	62
Thailand	110	141	140	66

CONVENTIONAL OIL					**Mb/d**
By Region	**2000**	**2005**	**2010**	**2020**	
ME-Gulf	18.6	24.7	32.0	24.8	
Eurasia	11.0	10.3	9.2	7.7	
N-America	5.2	3.9	2.9	1.6	
L.America	8.1	7.7	6.4	4.5	
Africa	6.5	7.0	5.8	4.0	
W.Europe	6.4	4.5	3.1	1.4	
Far East	4.0	3.4	2.6	1.4	
ME.Other	3.1	2.7	2.1	1.2	
Other	0.4	0.5	0.7	0.6	
Unforeseen	0.0	0.1	0.3	0.5	
Non-Swing	**45**	**40**	**33**	**23**	
Swing Share	29%	38%	49%	52%	
WORLD	**63**	**65**	**65**	**48**	
NON-CONVENTIONAL HYDROCARBONS					
Oil					**Mb/d**
Heavy Oils		1.3	2.1	2.1	2.0
	Canada	0.7	0.7	0.7	0.8
	Venezuela I	0.7	0.6	0.6	0.5
	Venezuela II	0.0	0.7	0.7	0.7
	Other		0.1	0.1	0.1
Deepwater		2.2	5.8	9.1	5.7
	G. Mexico	0.9	1.6	3.3	2.1
	Brasil	0.2	1.2	2.9	1.0
	W.Africa	1.2	3.0	2.9	2.3
	Other	0.0	0.0	0.0	0.3
Polar		1.0	0.8	0.6	0.5
	Alaska	1.0	0.8	0.6	0.4
	Other	0.0	0.0	0.0	0.1
Other		0.6	0.9	1.2	1.8
Subtotal		**5**	**10**	**13**	**10**
GAS & GAS LIQUIDS					
Gas (by value at 10Tcf = 1 Gboe)					
Gas		24	27	32	33
Non-con gas		4	5	5	7
Subtotal		**29**	**31**	**37**	**40**
Gas Liquids					
Condensate/NGL		**7**	**7**	**9**	**9**
ALL HYDROCARBONS					
Gas		**29**	**31**	**37**	**40**
Liquids		**75**	**82**	**87**	**67**
Total		**104**	**113**	**124**	**107**

BALANCE	at notional annual 1.8%			
Liquids Mb/d	demand growth			
Supply	75	82	87	67
Demand	75	82	90	107
Balance	0.0	-0.1	-2.7	-40.1
Price shocks from growing swing share mean				

Cameroon	101	71	51	25	demand is in reality unlikely to grow
Bahrain	102	61	36	13	**NOTES**
Turkey	57	44	35	21	Heavy Oils = oil from coal, "shale", tarsand & oil
Hungary	27	23	20	14	<17.5 API
Sharjah	45	48	40	28	Venezuela I = normal heavy oil
Croatia	23	22	20	17	Venezuela II = 4 contracted Extra-Heavy oil
Netherlands	51	32	20	8	projects
Austria	20	17	14	9	(Most "Other Heavy" included in Conventional
France	29	23	19	12	due to database limitations)
Papua	69	87	62	31	
Bolivia	34	29	25	18	
Albania	6	6	6	27	ME Gulf is treated as "swing"
Pakistan	55	41	30	17	
Philippines	1	58	73	43	
Chile	9	7	6	4	**ALL INPUT DATA APPROXIMATE**