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M. KING HUBBERT CENTER
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FORECASTING GLOBAL OIL SUPPLY 2000-2050

by Colin J. Campbell

The Conflict

Few would deny that the world runs on oil. By describing oil as a fossil fuel, everyone admits that it was formed in the past, which means that we started running out when we consumed the first barrel. That much can surely be agreed, even if opinions differ about how far along the depletion curve we are.

On one side of the debate stand the economists, whose views are summed up by the Emeritus Professor, M.A.Adelman:

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

On the other side, stand the natural scientists, who have been trained to observe Nature and understand its immutable physical laws. When they look as the issue, they ask two simple questions:

How much was found? and
When was it found?

They want this information to extrapolate the past discovery trend to show what is likely to be found in the future. They recognize that **oil has to be found before is can be produced,** meaning that the production trend has, in some manner, to reflect an earlier discovery trend. They know that an oilfield contains what it contains, because it was filled in the geological past, even if the amount it holds is not at first known accurately.

The amounts involved are commonly described in terms of Reserves and Resources, which are, however, often used in different senses. In plain language, we need to know the following parameters:

1. How much has been produced to-date (*Cumulative Production*);
2. Estimates of how much remains to be produced from known fields (*Reserves*); and
3. Estimates of how much will be produced from new fields (*Yet-to-Find*);
4. The total endowment, being the sum of these elements (*Ultimate Recovery*)

Denial and Obfuscation

The dispute between rival disciplines is further clouded by vested interests with motives to confuse. The implications of the decline of the world's premier energy source are so pervasive that in political terms it is easier "not to know". This is certainly the position of the International Energy Agency in Paris, on which many governments rely. It in turn has been able to hide behind a new study by the eminently respectable United States Geological Survey, which in a new report of 2000 has claimed near limitless resources. The oil companies come in too with bland public relations imagery, knowing full well that any mention of the dreaded word *Depletion* would smell like a dwindling asset to the investment community. The critical issue is not so much when oil will eventually run out, but rather when production will reach a peak and begin to decline, which will represent a major watershed for the world's economy.

The Flawed USGS Report

Some serious questions should be asked about the USGS methodology. In brief, it made an academic assessment of the *subjective* probability of new discovery in each of the world's basins, tacitly assuming an infinite number of wildcats to find it. For example, in an unknown, untested, basin in East Greenland, it concluded that there was a 95% probability (F_{95}) of finding more than zero, namely at least one barrel, and a 5% probability (F_5) of finding more than 112 billion barrels. A Mean value of 47 billion was computed from this range. Since the numbers were quoted to three decimal places, the reader could be forgiven for assuming them to be accurate. But a moment's reflection would question the very concept of a *subjective* 5% probability. In plain language, it was a guess that could as well be the half or the double, yet it entered the calculations distorting the critical Mean value. We are now seven years into the study period and can compare the forecast with what has been found in the real world. The USGS forecast, as a Mean estimate, that 674 Gb (billion barrels) are to be found between 1995 and 2025, which means an average of 25 Gb a year. So far, the average has been only 10 Gb, when above average performance should be expected because the larger fields are usually found first because they are the biggest targets.

Figure 1 shows that only the low (F_{95}) case bears any reasonable relationship with the past actual trend, which, it is stressed, resulted from the diligent efforts of the industry in a worldwide quest for the biggest and best prospects. The industry had the benefit of all the much-vaunted advances of technology and geological knowledge. If more could have been found, it would have been found, especially recognizing that the international industry operates under extraordinarily favorable economic terms whereby the cost of exploration is offset under high marginal tax rates. In many countries, it was effectively spending 10¢ dollars on exploration.

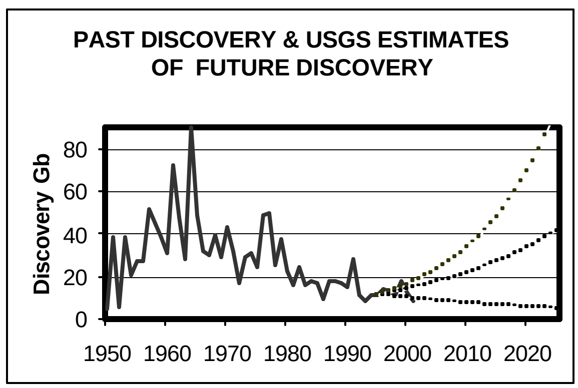

Figure 1

Discovery trends implied by the USGS estimates of the amount of oil between 1995 and 2025. Evidently only the low estimate (having a high probability) bears any reasonable relationship to the past discovery trend in the real world.

Not content with exaggerating the Undiscovered potential, the USGS went on to add Reserve Growth, based on US onshore experience on which it had data. It failed to understand the nature of reserve reporting. Stated in plain language, *Proved Reserves*, as reported for financial purposes, refer to what the existing wells of the current stage of an oilfield's development are expected to deliver: in other words, they are *Proved So Far*, saying little about the eventual size of the field as a whole. In the case of the large old fields, initially reported *Proved Reserves* understated the ultimate field size by as much as one-third, as is amply documented by mature North Sea fields or Prudhoe Bay in Alaska. However, most of the offshore finds over the past decade are too small to have more than one development phase, so their initially reported *Proved Reserves* may indeed represent what the fields can deliver. Accordingly, the USGS made the double mistake of assuming that the experience of the old onshore fields of the Lower-48 United States was even remotely representative of the offshore or international arena, and secondly of applying the growth factor of the past to the more recent smaller fields.

A more realistic approach

In trying to explain the real position, the first step is to define clearly the different categories of oil, distinguishing the easy and cheap, commonly called *Conventional*, from the expensive and difficult. Public data on reserves are extremely unreliable, but if we employed a detective to piece together all the evidence and clues, he would likely report the following rounded numbers for narrowly defined conventional oil (see Tables 1 and 2, which are updated annually by C.J.Campbell).

	World	Persian Gulf*	Russia	
Produced-to-date	875	225 (26%)	120 (14%)	billion barrels
Reserves	900	500 (53%)	70 (8%)	
Yet-to-Find	150	40 (29%)	15 (10%)	

*(Iran, Iraq, Kuwait, Saudi Arabia and the United Arab Emirates)

World demand naturally influences the rate of depletion. A Base Case Scenario might conclude that a near absence of spare capacity in late 2000 was forcing up the price of oil. Some analysts had expected prices to rise higher, but the economy reacted more quickly than expected as it moved into recession, reducing the demand for oil, and, with it, the pressure on oil prices. But as the economy recovers, oil demand will rise in parallel until it again hits the falling ceiling of capacity, when prices will soar, re-imposing recession in a vicious circle. For these reasons, the scenario assumes that demand will be on average about flat, giving a plateau of production until the five Swing countries of the Persian Gulf are no longer able to offset the decline of the rest of the world. This threshold is expected to be reached around 2010, when these swing countries would have to produce over 20 Mb/d (million barrels a day), or about 36% of world demand. World production would then have to commence its long-term decline at the then depletion rate. The long predicted "World Hubbert Peak" would have occurred.

Although described as a production "plateau", it is likely to be anything but flat. It will more likely be a period of recurring price surges, recessions, international tensions, and growing conflicts for access to critical oil supplies, as the indigenous energy supply situation in the United States and Europe deteriorates. The calls made on the individual swing countries are shown in Fig.2. They are considerable, even with flat world demand, especially if their reserves are still exaggerated as suspected. In the event that demand should be higher than anticipated, the peak would clearly come sooner, to be followed by a steeper decline.

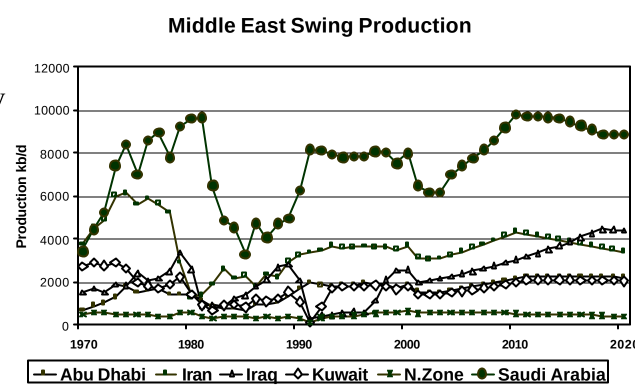

Figure 2

Assessed allocation of swing production to the member countries, illustrating the heavy demands made upon them.

Non-Conventional Oil
So much for conventional oil, which is the easy, cheap stuff that has supplied most oil to-date and will dominate all supply far into the future, but there are also other, more difficult and expensive, sources of oil. The economists tend to claim that they can be progressively tapped as the need arises, but the sad truth is that they can come on only slowly for the very reason that they are expensive and difficult to extract. They cannot accordingly have much impact on peak although they will ameliorate the subsequent decline.

They are subject to their own depletion profiles, which are less readily modelled.

Heavy Oil
Oils heavier than 17.5° API are here treated together, with production being controlled by extraction rate rather than the resource base. The assessment shows production rising gradually to 4.5 Mb/d by 2020 (Table 2).

Deepwater Oil (>500m water depth)
The deepwater domain is characterized by special geological conditions. Prolific oil generation occurred only in certain divergent plate-tectonic settings having early rifts in which source rocks were deposited and preserved. The right conditions are probably confined to the Gulf of Mexico and margins of the South Atlantic. Elsewhere, deltas may locally extend into deep water, but are likely to be gas prone because they have to rely on the source-rocks within the delta itself.

It is evident that deepwater operations test technology and management to the limit, which means in turn that only the larger prospects or clusters of prospects are likely to be viable. A further constraint is the availability of floating production equipment. It is concluded that deepwater production, from an endowment of about 60 billion barrels, might rise, with heroic effort, to a peak of about 8 Mb/d by 2010.

Polar Oil
Antarctica has very limited geological prospects, and is in any case closed to exploration by agreement. The Arctic regions of Alaska, Canada, Greenland, Norway and Russia are more promising with some huge sedimentary basins. However, the evidence to-date suggests that they are gas-prone, save for northern Alaska and parts of Siberia. The development of these remote and hostile areas calls for substantial very high-risk investment which is unlikely to bear fruit for many years, if indeed it ever does.

Natural Gas
We need also to consider natural gas as a substitute for oil. Its higher molecular mobility means that it depletes very differently from oil. Gas was more widely generated in nature than was oil, but required a better seal to hold it in the reservoir, much having been lost over geological time. Production is generally capped to provide a long plateau, set by pipeline capacity, with most fluctuation being seasonal. The capped production provides in-built spare capacity, which is progressively drawn down under market pressures that normally reduce price. The end of the plateau comes abruptly when this in-built spare capacity has been exhausted, and it comes without market signals. It appears that the United States is now close to the end of its plateau, such that new gas wells have to be produced at maximum rate, being depleted in a matter of months. It is increasingly forced to rely on Canadian imports, which themselves are subject to the same depletion pressures (see HCN#2002/2-2).

It is difficult to model gas supply since so much depends on undefined market forces and the construction of new pipelines. Based on the consensus endowment of 10,000 Tcf (trillion cubic feet), production is here expected to rise to a long plateau from 2015 before eventually declining. The depletion profile with its abrupt end carries grave risks to supply unless properly evaluated and anticipated.

Natural Gas Liquids (NGL)
The production of gas in turn gives a substantial supply of NGL, especially as the percentage extracted is likely to increase, as indicated by information provided by the US DoE/EIA. Natural Gas Liquids will form an important additional supply around oil peak, but will eventually decline in parallel with the natural gas.

Non-Conventional Gases
Non-conventional gases are important too. The two most promising are Arctic gas, much from Siberia, and coalbed methane from the world's coal basins. Gas hydrates from the ocean depths can be confidently dismissed. They occur mainly as disseminated granules and laminae, meaning that the methane cannot migrate to accumulate in commercial quantities. Some of the reported thicker hydrate deposits appear to be nothing more than seepages of conventional gas on the seabed.

Future Global Oil and Gas Production
Figure 3 summarises our assessment of the overall peak, illustrating the various components. The watershed for oil comes around 2010, followed five years later by the peak of oil and natural gas combined. The indicated supply constraints must inevitably curb demand by higher prices or in other ways, so that the historical pattern of economic growth has to end.

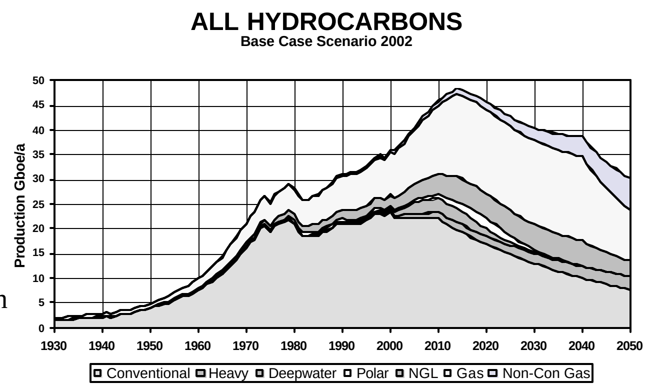

Figure 3

Forecast production of all hydrocarbons under a base case scenario of flat average demand for conventional oil from recurring price shocks and consequential recessions until 2010, when the Middle East swing producers can no longer offset the decline elsewhere.

Oil discovery in the United States peaked in 1930 with the discovery of the East Texas field. Peak production inexorably followed forty years later, but no one particularly noticed as cheap imports made up the difference. Since then, the same pattern of peak and decline has been repeated from one country to another, save for the Middle East, and the time lag from peak discovery to peak production is falling thanks to modern technology. Given that peak world discovery was passed in 1964, it should be no surprise that the corresponding peak of global production is now getting close. Exactly when it will come depends on many short-term factors, not least of which would be military intervention in the Middle East. The base-case scenario points to 2010, but it could come sooner if economic recovery should drive up the demand for oil. The question is not WHETHER, but WHEN oil production will peak.

Oil, which provides about 40% of global energy needs, and about 90% of transport fuel, is set to start to decline within about ten years. It is evident that the World will have to learn to use less, much less, which should not be difficult given the current waste. There is a great deal at stake as solutions have long lead times and call for difficult adjustments, but much could be done if governments could be alerted in time. Those countries that do plan and prepare will clearly have great advantage over those that simply react to the crisis when it hits them.

RESOURCE BASED PRODUCTION FORECAST

Base Case Scenario

CONVENTIONAL OIL (Million Barrels/Day)

Mb/d	2000	2005	2010	2020
Saudi Arabia	8.00	7.42	9.81	8.88
Russia	6.33	8.38	9.25	4.85
US-48	4.45	3.84	2.72	1.37
Iraq	2.57	2.38	3.04	4.40
Iran	3.68	3.41	4.35	3.42
Venezuela	2.57	2.32	2.12	1.77
Kuwait	1.77	1.57	2.00	2.04
Abu Dhabi	1.90	1.69	2.16	2.20
Mexico	3.01	2.88	2.41	1.68
China	3.24	3.02	2.43	1.57
Nigeria	2.03	2.11	1.99	1.46
Libya	1.41	1.37	1.29	1.07
Kazakhstan	0.68	0.96	1.22	1.72
Norway	3.21	2.73	1.96	1.01
UK	2.51	1.77	1.31	0.72
Indonesia	1.27	1.02	0.83	0.56
Algeria	0.81	0.82	0.82	0.69
Canada	1.08	0.90	0.74	0.50
Azerbaijan	0.28	0.68	0.82	0.82
N.Zone	0.63	0.55	0.53	0.41
Oman	0.93	0.88	0.70	0.45
Egypt	0.81	0.62	0.49	0.30
Qatar	0.69	0.51	0.43	0.31
India	0.65	0.61	0.50	0.34
Australia	0.70	0.54	0.44	0.29
Argentina	0.75	0.53	0.34	0.14
Colombia	0.69	0.51	0.40	0.24
Malaysia	0.69	0.59	0.45	0.27
Angola	0.74	0.57	0.45	0.28
Romania	0.12	0.11	0.10	0.08
Ecuador	0.40	0.41	0.36	0.24
Brasil	0.36	0.30	0.23	0.14
Syria	0.52	0.38	0.26	0.12
Turkmenistan	0.14	0.16	0.14	0.12
Dubai	0.28	0.17	0.12	0.06
Brunei	0.18	0.15	0.12	0.08
Trinidad	0.12	0.10	0.09	0.06
Gabon	0.33	0.21	0.14	0.06
Ukraine	0.07	0.07	0.06	0.05
Peru	0.10	0.09	0.08	0.06
Yemen	0.35	0.31	0.22	0.11
Vietnam	0.30	0.30	0.26	0.13
Uzbekistan	0.16	0.17	0.20	0.12
Denmark	0.36	0.28	0.20	0.09
Congo	0.27	0.19	0.12	0.05
Germany	0.06	0.06	0.04	0.03
Tunisia	0.08	0.06	0.05	0.04
Italy	0.09	0.07	0.06	0.04
Bahrain	0.10	0.07	0.05	0.02
Thailand	0.11	0.14	0.14	0.07
Sudan	0.19	0.19	0.19	0.07
Cameroon	0.09	0.05	0.03	0.01
Netherlands	0.03	0.02	0.02	0.02
Bolivia	0.03	0.04	0.05	0.04
Turkey	0.06	0.05	0.04	0.02
Croatia	0.02	0.03	0.02	0.02
France	0.03	0.02	0.02	0.01
Austria	0.02	0.02	0.01	0.01
Papua	0.07	0.05	0.05	0.03
Hungary	0.03	0.02	0.02	0.01
Albania	0.01	0.01	0.03	0.03
Sharjah	0.05	0.04	0.03	0.02
Pakistan	0.04	0.05	0.03	0.02
Chile	0.01	0.01	0.01	0.00

CONVENTIONAL OIL (Mb/d)

By Region	**2000**	**2005**	**2010**	**2020**
Arabian Gulf	18.54	17.01	21.88	21.34
Eurasia	11.06	13.60	14.29	9.38
N.America	5.53	4.74	3.47	1.87
L.America	8.04	7.19	6.08	4.39
Africa	6.73	6.19	5.58	4.05
Europe	6.32	4.98	3.62	1.93
Far East	4.00	3.45	2.83	1.78
ME Other	2.99	2.40	1.84	1.11
Other	0.65	0.66	0.60	0.37
Unforeseen	0.00	0.04	0.06	0.15
Non-Swing	**45**	**43**	**38**	**25**
Swing %	29%	28%	41%	47%
WORLD	**64**	**60**	**60**	**46**

NON-CONVENTIONAL HYDROCARBONS

OIL				Mb/d
Heavy Oils	1.41	2.76	3.56	4.57
Canada	0.95	1.34	1.97	2.77
Venezuela I	0.45	0.43	0.51	0.62
Venezuela II	0.00	0.65	0.65	0.65
Other		0.34	0.43	0.53
Deepwater	1.04	5.64	8.33	3.97
G. Mexico	0.27	1.86	2.52	0.68
Brasil	0.77	1.78	1.81	0.77
Angola	0.00	0.90	1.73	0.82
Nigeria	0.00	0.44	1.15	0.58
Other	0.00	0.66	1.12	1.12
Polar	1.09	1.17	1.84	5.68
Alaska	0.98	0.79	0.50	0.20
Other	0.11	0.38	1.34	5.48
Other	0.0	0.8	1.5	2.0
Subtotal	**4**	**10**	**15**	**16**

GAS & GAS LIQUIDS

Gas (by value at 10Tcf = 1 Gboe)				
Gas	23	30	38	47
Non-con gas	1.8	1.9	2.5	4.1
Subtotal	**25**	**32**	**41**	**51**
NGL	6	9	11	14

ALL HYDROCARBONS

Gas	25	32	41	51
Liquids	73	80	87	77
Processing Gain	1.5	1.6	1.7	1.5
Total	**100**	**113**	**129**	**129**

BALANCE

Liquids Mb/d	At notional +1.5% demand			
Supply	75	81	89	78
Demand	75	81	87	101
Balance	0.0	0.4	1.6	-22.9

NOTES

Conventional Oil here excludes:
Oil from coal & "shale"; bitumen; Extra-Heavy Oil; Heavy Oil (<17 API); Deepwater (>500m) & Polar Oil and NGL from gasfields

Base Case Scenario assumes flat conventional production until Swing Share reaches 22 Mb/d, the estimated Swing capacity limit by 2010

Abu Dhabi, Iran, Iraq, Kuwait & Saudi Arabia are treated as Swing Producers

Venezuela I = ordinary heavy
Venezuela II = 4 Extra-Heavy oil projects

Estimated by C.J.Campbell, ODAC 4/4/02

TABLE 1

	Base Case Scenario Unit:Gb (billion barrels)						CONVENTIONAL OIL ENDOWMENT (Excl. heavy, deepwater, polar, LNG)										2001 *Estimated by C.J.Campbell, ODAC. 4/4/02*
		PRODUCTION			RESERVES					DISCOVERED				%	Dep.	DATES	
			Cum.		Reported				Assessed		YET-TO-FIND			Disc	Rate		
		kb/d	Prod.	5yr	World	O&GJ	Adjust	Factor	Field			YET-TO-PRODUCE				MP	Peak
	Country	2001	Gb	Trend	Oil		+/-		Reserves				ULTIMATE			Dep	Prod
1	Saudi Arabia	6470	91.24	-4%	263.00	259.25	0.0	0.75	194.44	285.7	14.3	208.8	300	95%	1.1%	2020	2012
2	Russia	6895	121.47	3%	52.66	48.57	-4.8	1.5	65.62	187.1	12.9	78.5	200	94%	3.1%	1992	1987
3	US-48	4430	169.02	-2%	21.33	22.05	-9.0	1.5	19.57	188.6	6.4	26.0	195	97%	5.9%	1971	1971
4	Iraq	1960	26.53	14%	115.00	112.50	-3.3	0.87	94.97	121.5	13.5	108.5	135	90%	0.7%	2032	2018
5	Iran	3130	52.91	-3%	96.40	112.50	-3.8	0.82	70.47	123.4	6.6	77.1	130	95%	1.5%	2010	1974
6	Venezuela	2406	45.42	-2%	47.62	77.69	-30.0	0.9	42.92	88.3	6.7	49.6	95	93%	1.7%	2003	1970
7	Kuwait	1440	30.14	-4%	96.50	94.00	-6.0	0.63	55.43	85.6	4.4	59.9	90	95%	0.9%	2022	2013
8	Abu Dhabi	1555	17.29	-3%	61.92	92.20	-7.4	0.7	59.39	76.7	3.3	62.7	80	96%	0.9%	2031	2013
9	Mexico	3100	28.82	1%	26.94	26.94	0.0	0.95	25.59	54.4	7.6	33.2	62	88%	3.3%	2003	2003
10	China	3295	27.33	1%	34.10	24.00	-13.3	2.3	24.51	51.8	5.2	29.7	57	91%	3.9%	2002	2003
11	Nigeria	2100	21.68	-2%	24.50	24.00	-4.4	1.45	28.38	50.1	1.9	30.3	52	96%	2.5%	2008	1979
12	Libya	1360	22.40	-1%	29.50	29.50	-2.0	0.93	25.57	48.0	3.0	28.6	51	94%	1.7%	2007	1970
13	Kazakhstan	787	5.70	11%	6.42	5.42	-0.5	4.75	23.20	28.9	6.1	29.3	35	83%	1.0%	2024	2024
14	Norway	3133	15.12	0%	10.03	9.45	-2.3	2.25	16.05	31.2	2.8	18.9	34	92%	5.5%	2003	2000
15	UK	2260	18.78	-2%	5.00	4.93	0.0	2.25	11.09	29.9	2.1	13.2	32	93%	6.1%	1998	1999
16	Indonesia	1200	19.41	-2%	9.67	5.00	0.0	1.8	9.00	28.4	1.6	10.6	30	95%	4.0%	1992	1977
17	Algeria	820	11.83	-1%	13.00	9.20	-2.9	2.4	15.16	27.0	3.0	18.2	30	90%	1.6%	2011	1978
18	Canada	1055	18.35	-1%	5.62	4.86	0.0	1.8	8.74	27.1	0.9	9.6	28	97%	3.8%	1990	1973
19	Azerbaijan	300	8.01	13%	-	0.00	-0.2	7	6.78	14.8	3.2	10.0	18	82%	1.1%	2005	2007
20	N.Zone	540	6.42	0%	4.65	5.00	-1.8	2.65	8.45	14.9	0.6	9.1	15.5	96%	2.1%	2008	2004
21	Oman	960	6.65	1%	5.85	5.51	-0.7	1.4	6.74	13.4	1.6	8.3	15	89%	4.0%	2003	2003
22	Egypt	755	8.40	-2%	3.77	2.95	-0.6	2	4.75	13.2	0.8	5.6	14	94%	4.7%	1996	1994
23	Qatar	574	6.49	-2%	5.55	15.21	-10.0	1.1	5.73	12.2	0.8	6.5	13	94%	3.1%	2001	2000
24	India	640	5.34	-1%	3.34	4.84	0.0	1.25	6.05	11.4	0.6	6.7	12	95%	3.4%	2004	1997
25	Australia	640	5.55	3%	2.84	3.50	0.0	1.35	4.73	10.3	0.7	5.5	11	93%	4.1%	2001	2000
26	Argentina	760	7.99	-2%	2.96	2.97	0.0	0.95	2.83	10.8	0.2	3.0	11	98%	8.4%	1992	1998
27	Colombia	625	5.54	-1%	2.60	1.75	0.0	2.25	3.94	9.5	0.5	4.5	10	95%	4.9%	1999	1999
28	Malaysia	720	5.02	-1%	5.05	3.00	0.0	1.2	3.60	8.6	1.4	5.0	10	86%	5.0%	2001	1997
29	Angola	685	4.29	-1%	8.48	5.41	-8.2	-1.5	4.12	8.4	1.1	5.2	9.5	89%	4.6%	2000	1998
30	Romania	120	5.71	-3%	1.23	0.96	0.0	1.25	1.19	6.9	0.6	1.8	7.5	92%	2.4%	1973	1976
31	Ecuador	400	3.14	1%	3.10	2.12	-1.1	4	3.95	7.1	0.4	4.4	7.5	94%	3.2%	2007	2004
32	Brasil	360	4.39	-6%	8.47	8.46	-9.2	-2.2	1.62	6.0	1.0	2.6	7	86%	4.8%	1995	1989
33	Syria	515	3.60	-2%	2.15	2.50	-1.8	3	2.01	5.6	0.4	2.4	6	94%	7.3%	1998	1995
34	Turkmenistan	147	2.87	18%	-	0.55	-0.1	3.7	1.63	4.5	1.5	3.1	6	75%	1.7%	2003	1973
35	Dubai	230	3.63	-5%	0.93	4.00	-1.9	0.4	0.85	4.5	0.3	1.1	4.75	94%	6.9%	1987	1991
36	Brunei	180	2.93	5%	1.23	1.35	-0.6	2.1	1.48	4.4	0.1	1.6	4.5	98%	4.0%	1989	1978
37	Trinidad	112	3.15	-2%	0.72	0.72	0.0	1.4	1.00	4.2	0.3	1.3	4.5	92%	2.9%	1983	1978
38	Gabon	300	2.75	-4%	2.57	2.50	-1.5	1	1.02	3.8	0.2	1.2	4	94%	8.1%	1995	1996
39	Ukraine	74	2.63	-4%	-	0.40	-0.1	2.25	0.77	3.4	0.6	1.4	4	85%	1.9%	1984	1970
40	Peru	93	2.29	-2%	0.88	0.32	-0.6	-3.5	0.97	3.3	0.7	1.7	4	81%	1.9%	1994	1983
41	Yemen	350	1.49	-1%	2.10	4.00	-1.3	0.5	1.36	2.8	0.7	2.0	3.5	81%	6.0%	2003	1999
42	Vietnam	305	0.77	14%	1.75	0.60	-0.4	9.5	1.91	2.7	0.3	2.2	3	89%	4.8%	2008	2008
43	Uzbekistan	143	1.00	-3%	-	0.59	-0.1	3.4	1.65	2.6	0.4	2.0	3	88%	2.5%	1999	2009
44	Denmark	335	1.19	9%	1.11	1.11	0.0	1.1	1.22	2.4	0.6	1.8	3	81%	6.4%	2003	2000
45	Congo	260	1.42	1%	1.70	1.51	-1.8	-2.5	0.76	2.2	0.3	1.1	2.5	87%	8.1%	1999	2000
46	Germany	68	1.90	4%	0.31	0.36	0.0	1.05	0.38	2.3	0.1	0.5	2.4	95%	4.2%	1976	1966
47	Tunisia	66	1.17	-3%	0.31	0.31	-0.1	3	0.68	1.8	0.4	1.0	2.2	84%	2.3%	1995	1981
48	Italy	74	0.85	-7%	0.61	0.62	-0.1	1.5	0.79	1.6	0.1	0.9	1.75	93%	3.4%	2001	1997
49	Bahrain	103	1.19	0%	-	0.12	0.0	1.5	0.19	1.4	0.2	0.4	1.6	86%	8.5%	1988	1993
50	Thailand	114	0.38	10%	0.52	0.52	0.0	1.6	0.83	1.2	0.3	1.1	1.5	80%	3.6%	2008	2008
51	Sudan	200	0.16	422%	0.60	0.56	0.0	1.4	0.79	1.0	0.5	1.3	1.5	63%	5.2%	2010	2005
52	Cameroon	75	1.01	-8%	-	0.40	-0.6	-1.1	0.26	1.3	0.0	0.3	1.3	97%	8.5%	1993	1986
53	Netherlands	27	0.81	-10%	0.09	0.11	0.0	3.7	0.32	1.1	0.1	0.4	1.25	90%	2.3%	1991	1989
54	Bolivia	30	0.41	-1%	0.22	0.44	0.0	1.5	0.66	1.1	0.1	0.8	1.2	89%	1.4%	2013	2013
55	Turkey	56	0.81	-3%	0.28	0.30	0.0	1	0.25	1.1	0.1	0.4	1.2	89%	5.0%	1992	1991
56	Croatia	21	0.48	-7%	0.08	0.09	0.0	5	0.38	0.9	0.1	0.5	1	86%	1.5%	2003	1988
57	France	28	0.71	-5%	0.15	0.14	0.0	1.15	0.16	0.9	0.1	0.2	0.95	92%	4.0%	1987	1988
58	Austria	19	0.77	-2%	0.09	0.09	0.0	1.5	0.13	0.9	0.1	0.2	0.95	95%	3.6%	1971	1955
59	Papua	58	0.32	-5%	0.62	0.24	0.0	2	0.48	0.8	0.1	0.6	0.9	89%	3.5%	2008	1993
60	Hungary	24	0.70	-3%	0.06	0.11	0.0	1	0.11	0.8	0.1	0.2	0.9	90%	4.1%	1983	1994
61	Albania	6	0.53	-2%	-	0.17	0.0	1.5	0.19	0.7	0.1	0.3	0.8	90%	0.8%	1986	1982
62	Sharjah	45	0.45	-7%	-	1.50	0.0	0.1	0.15	0.6	0.2	0.3	0.8	76%	4.5%	1998	1998
63	Pakistan	59	0.44	3%	0.30	0.30	0.0	0.9	0.27	0.7	0.3	0.3	0.75	94%	6.4%	1998	1992
64	Chile	7	0.42	-4%	0.01	0.15	0.0	0.3	0.04	0.5	0.0	0.1	0.5	91%	3.0%	1979	1982
	REGION																
1	Arabian Gulf	15095	225	-2%	637.47	652.65	-22.3	0.766	483.14	708	43	526	751	94%	1.0%	2021	2013
2	Eurasia	11811	176	2%	94.55	82.03	-19.2	2.007	126.03	302	31	157	333	91%	2.7%	1999	2009
3	N.America	5485	187	-2%	26.95	26.90	-9.0	1.581	28.31	216	7	36	223	97%	5.3%	1973	1972
4	L.America	7893	102	-1%	93.52	121.56	-40.9	1.036	83.51	185	18	101	203	91%	2.8%	2001	1998
5	Africa	6621	75	-1%	84.42	76.33	-22.1	1.501	81.49	157	11	157	168	93%	2.5%	2005	1997
6	Europe	5942	40	-1%	17.39	16.81	-2.4	2.097	30.14	70.3	6.0	36.2	76.3	92%	5.7%	2000	2000
7	Far East	3916	40	0%	25.30	19.34	-1.0	1.548	28.33	68.5	5.2	33.5	73.7	93%	4.1%	1999	2000
8	ME Other	2833	24	-1%	16.85	33.13	-15.7	0.992	17.28	41.6	4.2	21.5	45.9	91%	4.6%	1999	1998
9	Other	660	3	16%		1.78	0.0	3	5.34	8.7	1.3	6.7	10	87%	3.5%	2008	2008
10	Unforeseen								0.00		17	17	17			2048	2048
	Non-Swing	45160	648	0%	359	378	-110	1.5	400	1049	101	501	1150	91%	3.2%	1997	2002
	WORLD	60255	873	-1%	996	1031	-133	1.0	884	1757	144	1027	1900	92%	2.1%	2005	2000

TABLE 2

Note: This paper is a condensed version of ODAC Newsletter #14, Feb. 2001.

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Colin J. Campbell took a Ph D in geology at Oxford before joining the oil industry as a field geologist in 1958. His career took him to many countries, including Trinidad, Colombia, Ecuador, USA, UK, Australia, New Guinea, and Ireland, ending as Executive Vice President of Fina in Norway in 1989. Since then he has dedicated himself to researching the subject of oil depletion, writing two books and numerous scientific papers.

Interest in the subject has increased greatly in recent years leading to lectures, broadcasts and TV programs. This effort culminated in the establishment of the Oil Depletion Analysis Centre ("ODAC") in London, made possible by the generous support from the Astor Family, and a network of European institutions and universities, known as the Association for the Study of Peak Oil ("ASPO"). A monthly newsletter that is issued to these entities may be seen on www.energiekrise.de (press ASPONews icon).

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96/1-3	Cutting Gas Taxes Will Make Things Worse	J. MacKenzie & K. Courrier	Fig.1 (Petrol Prices)
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# 97/1-1	King Hubbert – Updated	L. F. Ivanhoe	Fig. 1, 2, 3, 4, 5, 6, 7, 8
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# 97/2-1	A European View of Oil Reserves	Colin J. Campbell	
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# 98/2	Energy and Dollar Costs of Ethanol Production With Corn	David Pimentel	Table 1
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# 99/2	Is the World's Oil Barrel Half Full or Half Empty? It Depends Upon Whether You are an Economist or a Geologist!	Joseph P. Riva	
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# 99/3-1	Petroleum Positions of Brazil and Venezuela	L. F. Ivanhoe	Fig. 1, 2, Table 1
# 99/3-2	Foreseeable Permanent Global Crude Oil Shortage	L. F. Ivanhoe	Oilman's Column [1]
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# 99/4-1	Deepwater Oil – The End of the End Game	Colin J. Campbell	
# 99/4-2	Operator Budgets Leaving Little for Frontier Exploration: Are the Frontiers Dead?	Marshall DeLuca	

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H.C. NEWSLETTER

The M. KING HUBBERT CENTER FOR PETROLEUM SUPPLY STUDIES
located in the Department of Petroleum Engineering
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Golden, Colorado

The Hubbert Center has been established as a non-profit organization for the purpose of assembling and studying data concerning global petroleum supplies and disseminating such information to the public.

The question of WHEN worldwide oil demand will exceed global oil supply is stubbornly ignored. The world's oil problems, timing and ramifications can be debated and realistic plans made only if the question is publicly addressed. A growing number of informed US and European evaluations put this crisis as close as now to 2014. The formation of this center is to encourage a multi-field research approach to this subject.

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