

M. KING HUBBERT CENTER FOR PETROLEUM SUPPLY STUDIES

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WORLD OIL SUPPLY – PRODUCTION, RESERVES, AND EOR

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*“The weakness of intelligence is in discerning the turning points”
(J. Schlesinger: former CIA Director and Ex-Secretary of Defense and of Energy)*

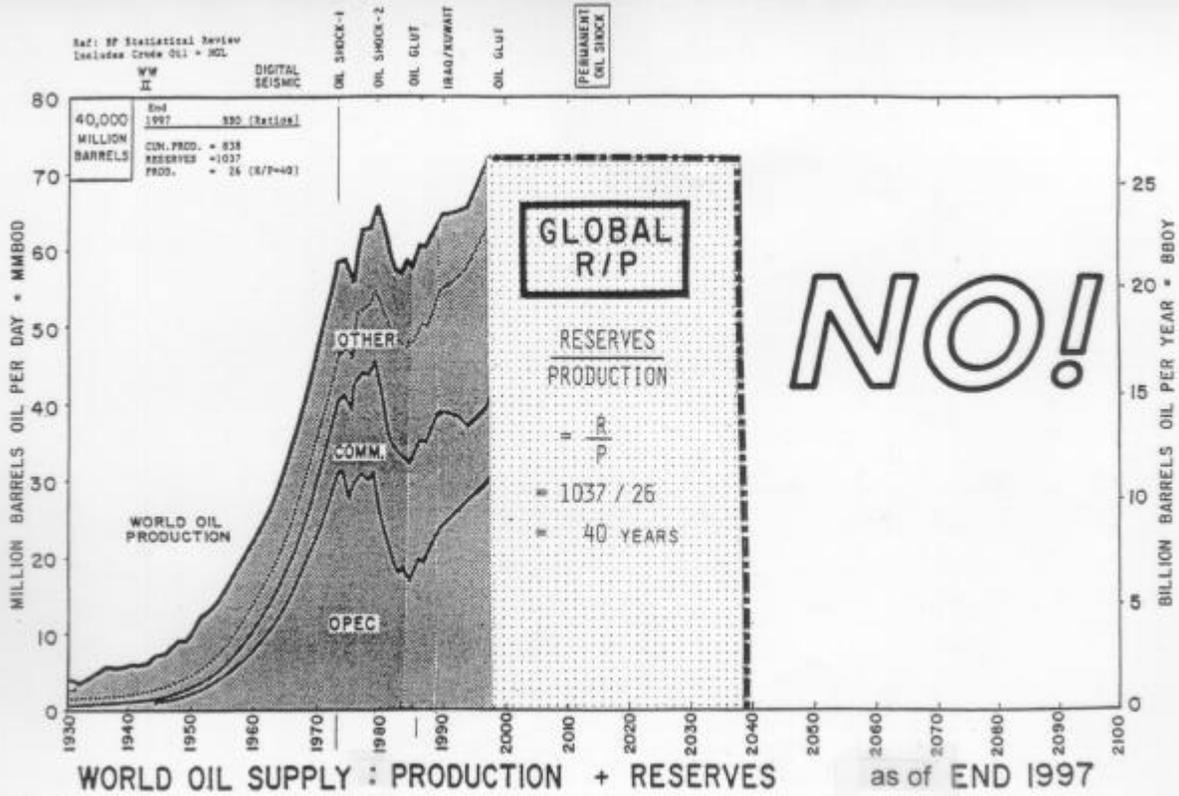
World Oil Consumption: Since 1980, the world has consumed far more oil than has been discovered. We are now finding only one barrel of new oil for every four barrels that we consume. As Donald Hodel, Ex-U.S. Secretary of Energy said: “We are sleepwalking into a disaster.”

Global R/P: (Figure 1-A). Economists and laymen routinely view the future of global oil production as being directly related to a simple global Reserves/Production (R/P) ratio. This implies that oil produced in all of the world’s fields will abruptly stop when the R/P date (40 years in the future) is reached. This is as unrealistic as to expect all humans to die off suddenly, instead of gradually. Global R/Ps should NOT be used to estimate timing of future oil supplies.

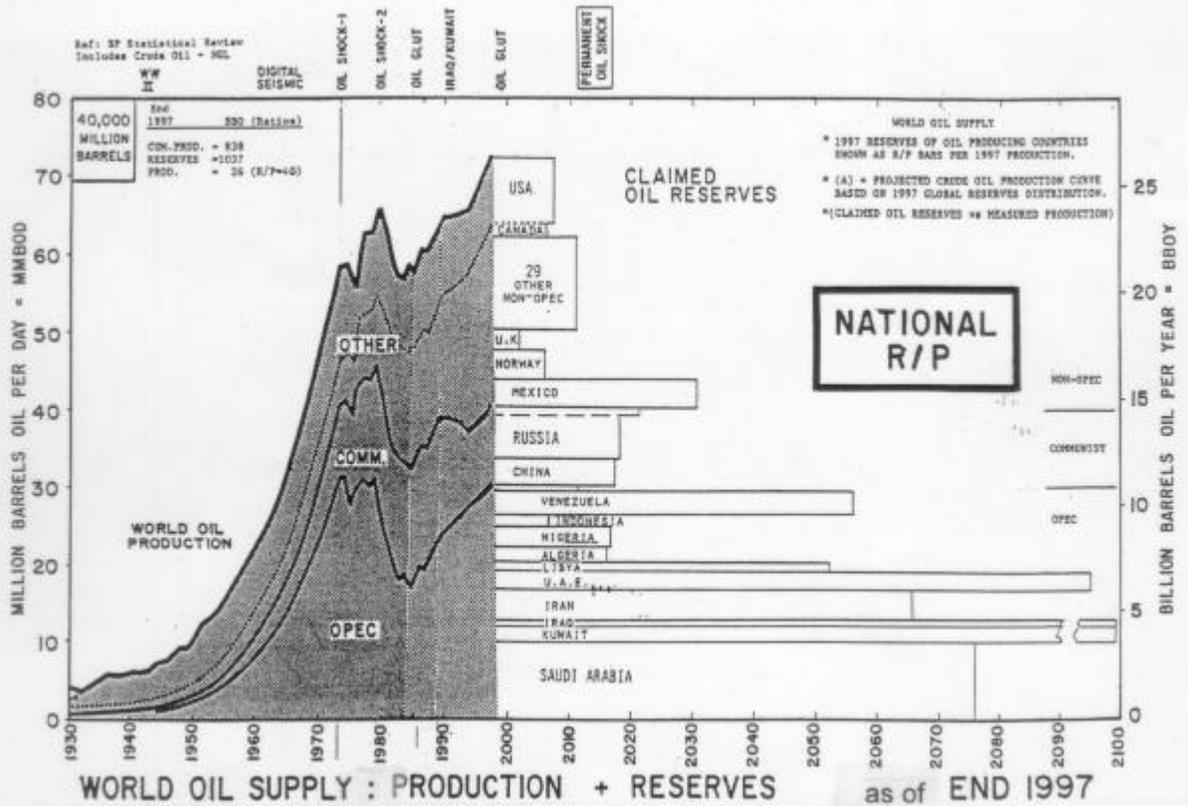
National R/P: (Figure 1-B). Instead of posting one average Global R/P of 40 years for the entire world, Figure 1-B shows (“National R/P”) for individual nations. This results in a very different, but a much more realistic semi-quantitative picture of the distribution of the world’s claimed oil reserves and future global oil supply than does Figure 1-A.

Scale: All of these graphs are drawn to scale, which puts tight limits on their construction and analysis. A 40,000-million-barrels (4 BBO/year x 10 years) rectangle in the upper left corner of each figure shows the graphic scale for the area under the World Production Curve (WPC). (BBO = Billion Barrels of Oil).

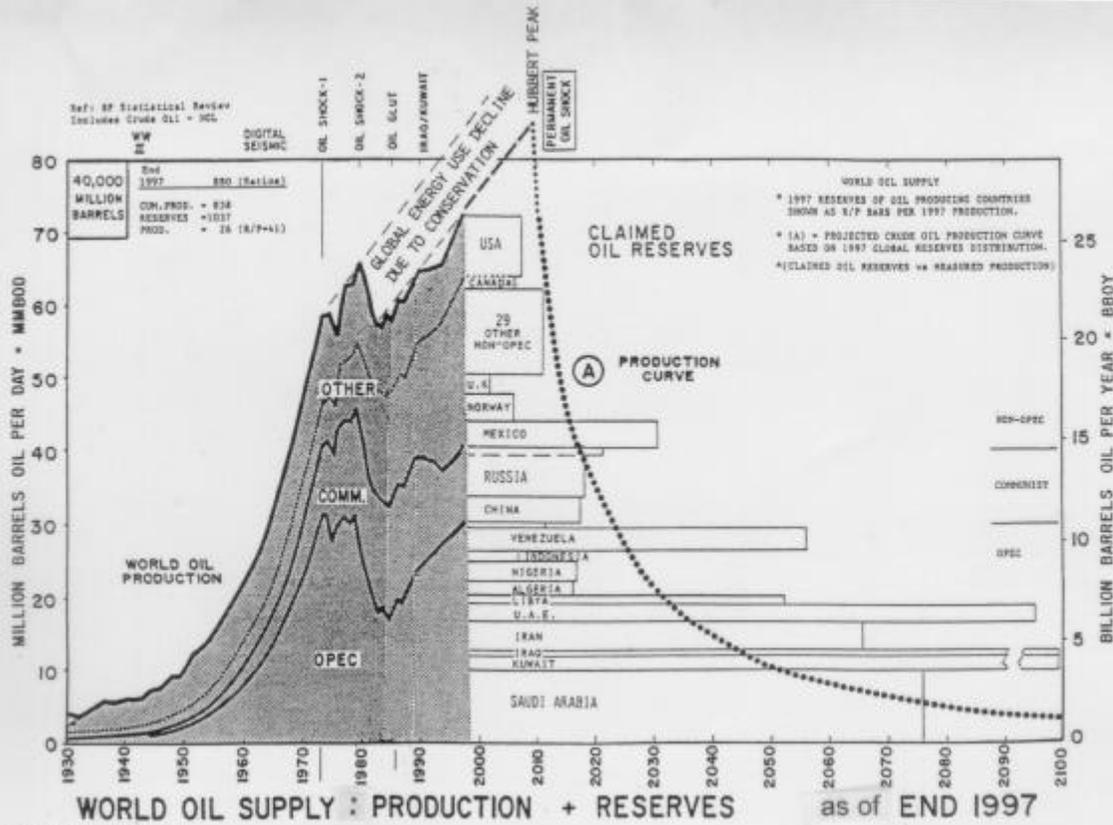
World Oil Production (WOP): Cumulative world production through 1997 was 838 BBO. Figure 1-B graphs details of the global oil production from 1930 through 1997. Heavy lines break down the WOP into “OPEC” (Organization of Petroleum Exporting Countries); “COMMUNIST” (Former Soviet Union/FSU & China); and “OTHER”, with the U.S.A. oil production above a dashed line at the top of the graph.



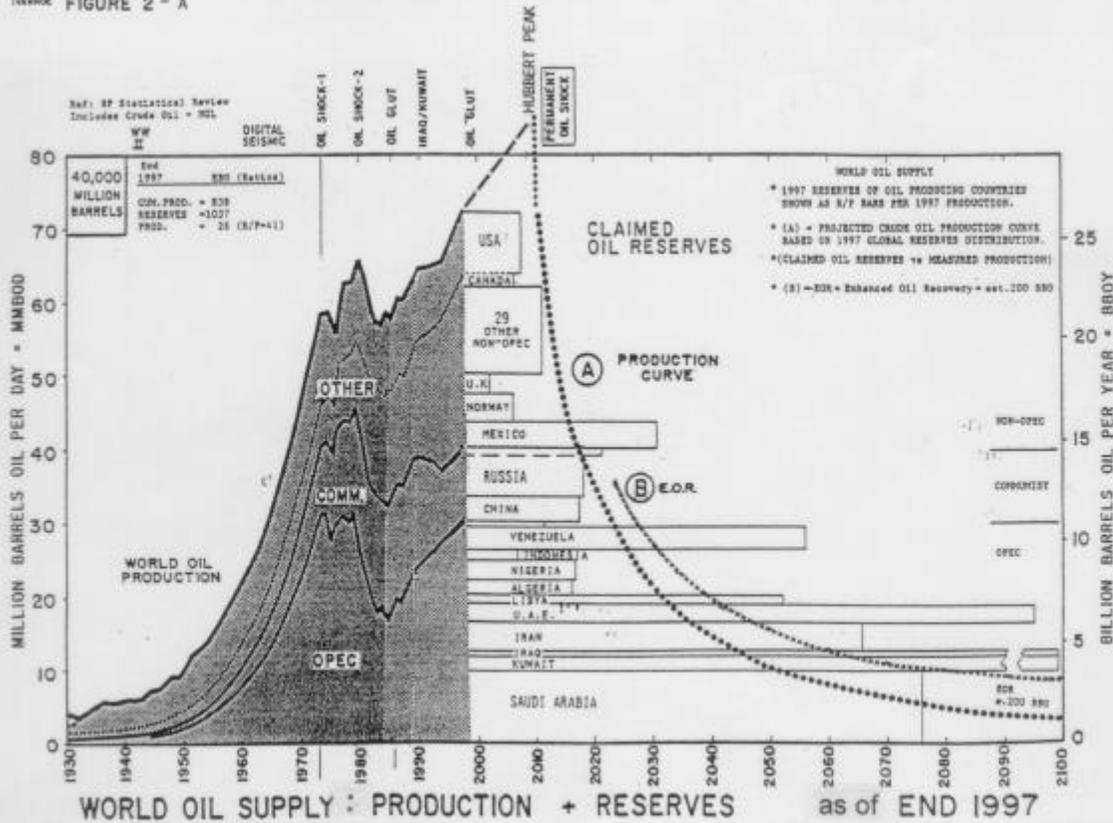
MARKER FIGURE 1 - A



MARKER FIGURE 1 - B
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INAHOC FIGURE 2 - A



INAHOC FIGURE 2 - B

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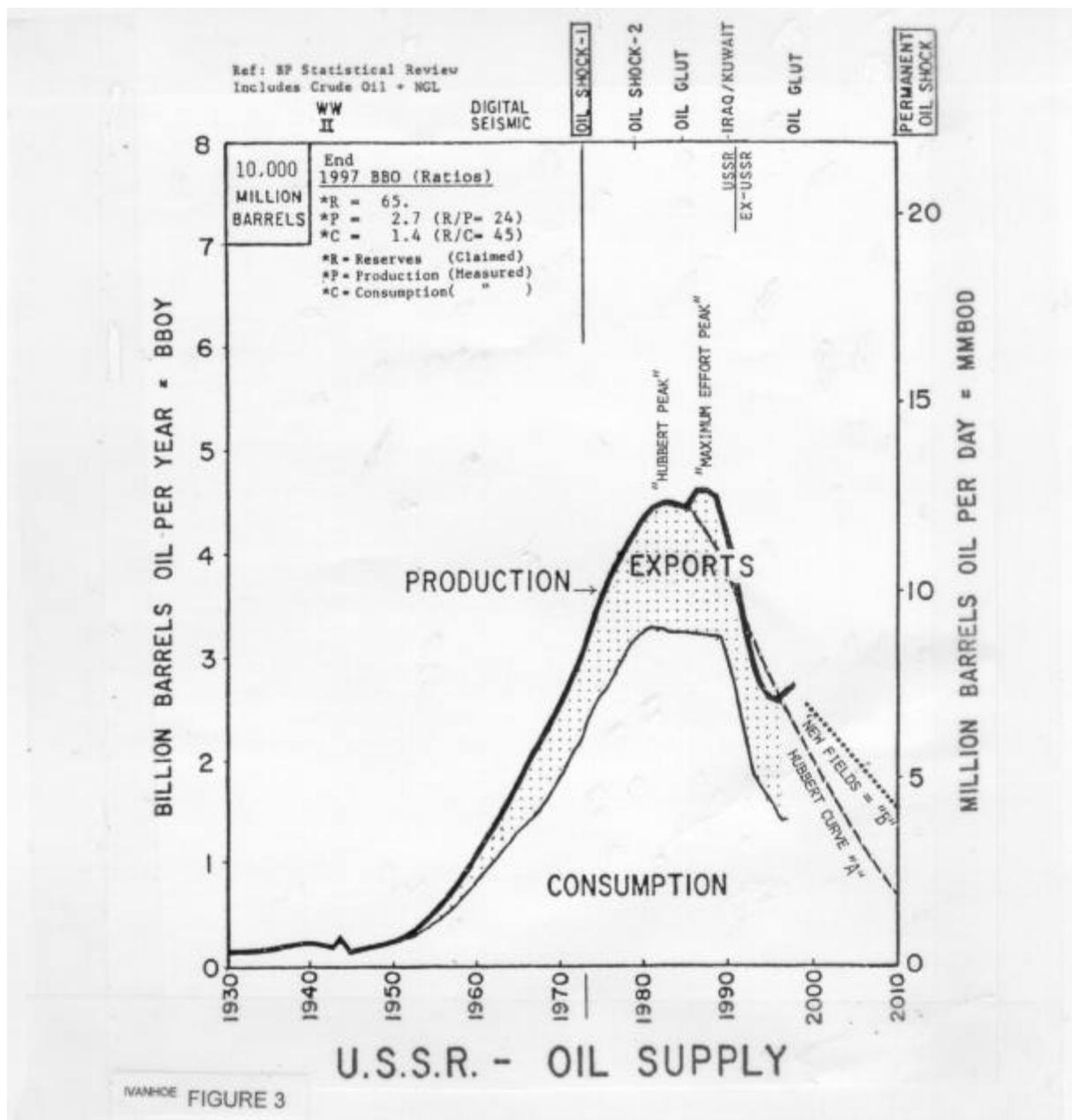
Claimed Oil Reserves (COR): COR at the end of 1997 per the British Petroleum “BP Statistical Review of World Energy (1998)”, are shown as horizontal bars per each nation’s computed R/P (= COR/Production). BP’s CORs are those reported to the Oil & Gas Journal (O&GJ) by governments for the annual O&GJ report on the world’s known/claimed oil. There is no way to assess how much of the claimed oil reserves may ever be produced, so they are all referred to as “Claimed” (COR) to indicate some degree of unreliability in all of the various reports. But these numbers are the best that we have, so we must use them. The BP/O&GJ numbers are deemed to be optimistic / political (“selling”) rather than conservative / engineers’ (“buying”) figures.

Future Annual Production: World oil production (Figure 2-A) has been projected from the 1983-1997 period to reach 85 MMBD in 2010. The sharp decline in global oil usage: 1979=64 MMBD (Millions Barrels/Day) to 1983 = 58 MMBD (a 10% drop) due to a worldwide “energy diet”/conservation (e.g. better insulation, improved motors, etc.) is strikingly similar on graphs of all kinds of energy consumption during the 1979 to 1985 period when oil prices surged. Most of the world’s “energy flab” was wrung out of the global energy usage at that time. (However, our U.S. 1990s SUV/Power Wagons are “energy obese.”)

Future Production Curve (FPC): The (Heavy Dots) curve was hand-drawn to closely fit a mirror image of the surging 1950-1973 global oil production. The general curve “A” may “shift to the right” in future years, but its shape is not expected to change. (The FPC will shift to the right if the annual production is not appropriately deducted from each nation’s COR, which has been the case during 1990-1998 for the Persian Gulf OPEC nations, FSU, and China.) The overall shape of the FPC curve is fixed by the facts. It is visually apparent that curve “A” fits the R/P bars quite well if the “post-Hubbert Peak” (Permanent Oil Shock) begins near 2010 at some 85 MMBD/31 BBOY. This “A” projection drops production from 85 MMBD in 2010 to 35 MMBD in 2020, (= 60%/10 years) which is in the same order-of-magnitude as the FSU experienced from 1989 (= 12.3 MMBD) to 1996 (= 7.2 MMBD), a production decline of 42% in seven years (= 60%/10 years). Such a roller coaster plunge is beyond the world’s experience. It is later than you think. All governments should seriously plan for this foreseeable oil supply crisis. (This will be one of J. Schlesinger’s “intelligence turning points”!)

EOR Curve “B” (Figure 2-B). To allow for potential improved / enhanced oil recovery (EOR) plus new discoveries, an additional 2 BBO/year = 200 BBO/100 years is shown as a Light Dash line added ABOVE Curve “A”. Adding such EOR will make no significant change in the world's long-term oil supply.

USSR/FSU Oil Supply: (Figure 3). This graph shows the Oil Production and Consumption of the FSU since 1930. The layout is similar, but the vertical scale differs from the World Graphs #1 & 2. The abrupt decline in production (42%/7 years) after 1989 is similar to the projected future curve “A” (= 60%/10 years) of Figure 2-A. The FSU example shows that such a major decline rate has already been experienced in a major oil-producing nation, so is realistic for global projections. (The timing of the 1989 oil drop following the “Maximum Effort Peak” may have contributed to the collapse of the USSR in 1991. The FSU has maintained its hard-currency oil exports since 1989 by reducing Russia’s internal oil consumption.)



Selected References

1. British Petroleum, 1998; B.P. 1997 Statistical Review of World Energy, June 1998. British Petroleum, Britannic House, 1 Finsbury Circus, London EC2M 7BA, UK.
2. Oil & Gas Journal, 1997; Worldwide look at reserves and production; O&GJ, Dec. 29, 1997, p. 38-39. (Annual summary at end of each calendar year.)
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OIL BUSINESS – UPSTREAM vs DOWNSTREAM

The oil industry has a unique business structure. Unlike the auto industry that integrates representatives from Design, Manufacturing, and Sales, the oil industry is divided into two distinct disciplines. The “UPSTREAM” operations of Exploration and Production find the underground crude oil and get it to the surface, while the “DOWNSTREAM” experts take care of the surficial Transportation, Refining, and Marketing.

Different skills are needed for each of the two disciplines. The general public, including economists and politicians, rarely comes in contact with Upstream personnel. Economists naturally concentrate their studies on the Downstream facet which they can readily understand and project, rather than on the Upstream factors. Upstream is the less predictable domain of the geologists and geophysicists who search for hidden underground oil and gas fields, and the petroleum engineers who get the oil from its subsurface reservoirs to the surface. While obvious to the Upstream specialists, the difference between discovered known “RESERVES” and undiscovered theoretical “RESOURCES” is rarely understood by economists, academics, and laymen – who routinely interchange and confuse the two technical terms (RESERVES / RESOURCES).

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WORLD'S OILFIELDS BY SIZES

DISTRIBUTION OF WORLD'S OIL FIELDS BY SIZE													Discovered 1859 to 1989			
Field grade	Estimated ultimate recovery million bbl	Size	Latin America	Western Europe	Africa	Middle East	East Asia	Austral- asia	Eastern Europe	FSU	China	Canada	Alaska	U.S. 48	World total	
AAAAA	50,000-	Megagiant	-	-	-	2	-	-	-	-	-	-	-	-	2	
AAAA	5-50,000	Supergiant	5	-	1	27	-	-	-	4	1	-	-	1	40	
AAA	500-5,000	Giant	40	14	36	120	11	2	2	28	17	12	2	44	328	
AA	100-500	Major	167	86	144	105	62	9	5	67	42	34	5	235	961	
A	50-100	Large	101	75	109	67	58	3	2	96	23	34	2	325	895	
B	25-50	Medium	148	100	158	56	73	24	8	84	38	64	1	355	1,109	
C	10-25	Small	255	151	363	99	207	13	15	96	61	107	1	760	2,218	
D	1-10	Very small	596	291	444	48	435	78	47	237	54	283	1	4,598	7,112	
E	0.1-1	Tiny	496	231	155	9	162	83	37	6	6	131	1	9,532	10,849	
F	0-0.1	Insignificant	204	142	21	4	75	45	6	-	-	233	1	11,020	11,751	
*N.D.°	†0-0.5	(Very Tiny)	-	-	-	-	-	-	310	1,046	92	41	-	†4,500	5,989	
Total			2,012	1,090	1,431	537	1,083	257	432	1,664	334	939	15	31,370	41,164	

° From publications. †Estimated. * = No Data

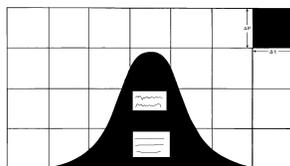
Ref: Ivanhoe & Leckie; Oil & Gas Journal, 2/15/1993, p. 87-91.

This table breaks down by sizes the world's known oil fields at the end of 1989. The global field distribution has changed little since this table was compiled. The 1331 known fields of “MAJOR” or larger size contain 94% of all crude oil found to 1989 in the entire world. Seventy-five percent of the earth's oil production and 90% of its oil reserves are in the hands of State-owned oil companies. The U.S./48 has 31,370 oil fields or three times the number (9779) in all the rest of the world combined, and 29,650 of the U.S./48 oil fields are of “very small” to “insignificant” size (EUR = 0 to 10 million barrels).

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L.F. (Buzz) Ivanhoe, Petroleum Consultant, Ojai, California, is a registered geologist, geophysicist, engineer and oceanographer with 50 years domestic and international experience in petroleum exploration with various private and government oil companies. He is a very practical oilman. He was associated with Occidental Petroleum from 1968 to 1980 where he was senior advisor of worldwide evaluations of petroleum basins from 1974 to 1980. On leaving Oxy, he moved to Santa Barbara and formed Novum Corp., an international energy exploration consulting firm. Now located in Ojai, Mr. Ivanhoe is the author of numerous papers on various technical subjects, including more than 50 on the evaluation of foreign prospective basins and projections of future global oil supplies. He is the coordinator of the Colorado School of Mines - M. King Hubbert Center for Petroleum Supply Studies.

H.C. NEWSLETTER



The M. KING HUBBERT CENTER FOR PETROLEUM SUPPLY STUDIES

located in the Department of Petroleum Engineering
Colorado School of Mines
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 the years 2000 - 2014. The formation of this center is to encourage a multi-field research approach to this subject.

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