HUBBERT CENTER NEWSLETTER # 2000/4-1

M. KING HUBBERT CENTER
FOR PETROLEUM SUPPLY STUDIES

M. KING HUBBERT CENTER
Petroleum Engineering Department
COLORADO SCHOOL OF MINES
GOLDEN CO 80401-1887

EXPORTS – THE CRITICAL PART OF GLOBAL OIL SUPPLIES

L. F. Ivanhoe

Global crude oil supplies require all of us to think at a global scale. The world has been consuming far more oil than has been discovered since 1980. We now burn four barrels of oil for each barrel discovered.

Our world is rapidly approaching a state where the global crude oil production will no longer be able to supply total global oil demand. Radical social changes will then be in store for all oil importing nations. A key timing factor is the amount of crude oil available from the world's oil exporting countries.

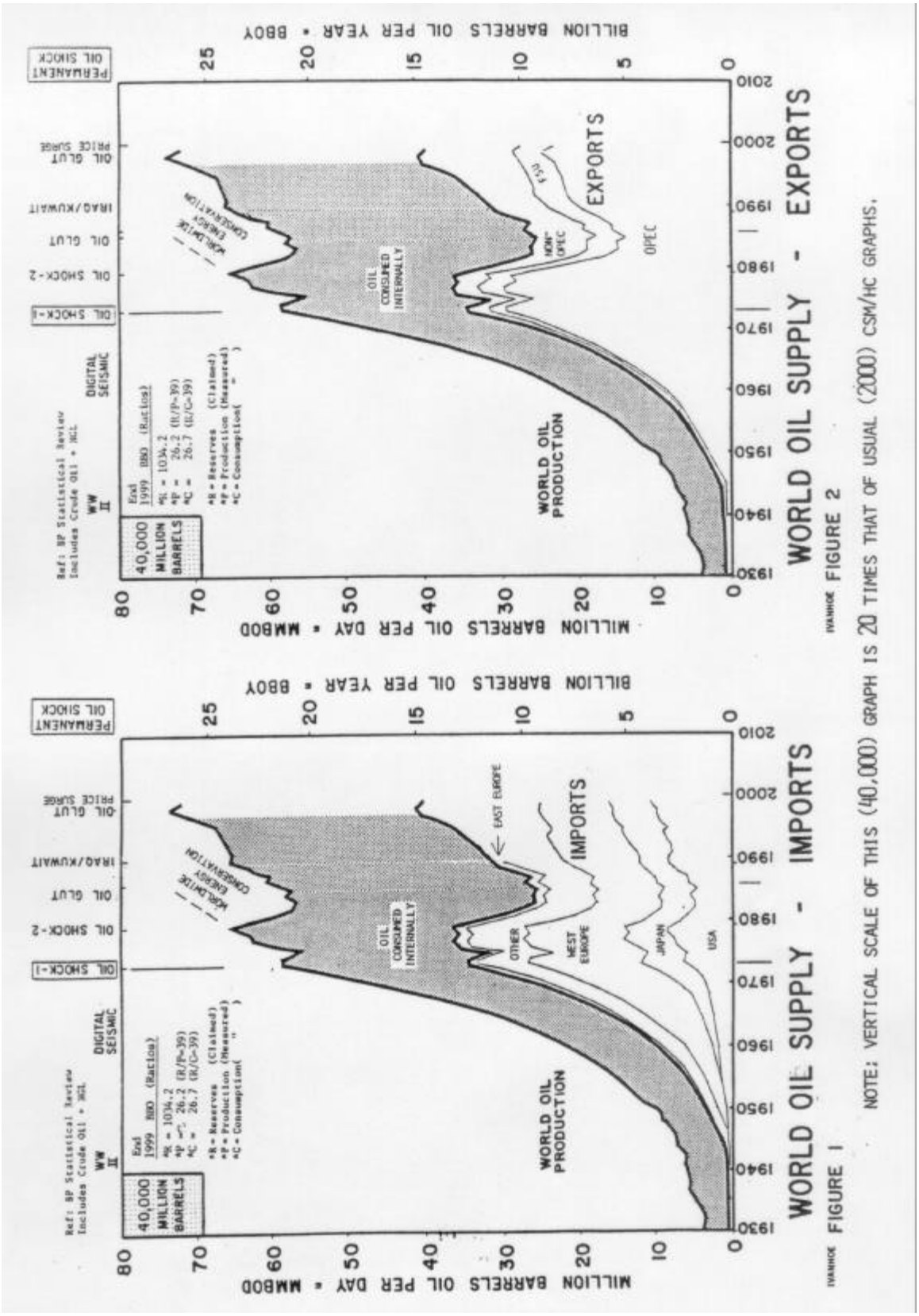
The critical factor for meeting global crude oil needs is not the world's total oil production, but the amount of net global production that is available for EXPORTS.

Figures 1 and 2 summarize the annual World Oil Supply from 1930 to 1999. Figure 1 shows OIL IMPORTS and Figure 2 shows OIL EXPORTS. Annual global oil IMPORTS should equal EXPORTS except for the varying amounts of oil in stock tanks and in tankers at sea. The cumulative production scale of the area under the heavy production curve is given by the 40,000 MMB rectangle (4BBOY x 10 years) in the upper left corner of each graph. This is 20 times the vertical scale of the usual of HC graphs. The upper (dark dot pattern) of each graph shows the total oil consumed internally within the producing nations. The lower (white) portion of each graph shows the volume of oil for each of the principal IMPORTING & EXPORTING nations/regions. The USA is now the world's largest crude oil and products importer (58% of consumption), in spite of its still substantial domestic oil production, (#2 in the world in 1999).

A true world-wide oil market now exists in which oil products consumed within any country sell at an international price set by the world's leading (OPEC) exporters, adjusted locally for transportation, quality, and fuel taxes or subsidies. The global oil price is set by competition/collusion between oil exporting countries – not by the oil importing consumers, stock brokers, economists, planners, or politicians. U.S. anti-trust laws do not apply to sovereign foreign governments, which can unilaterally refute/manipulate contracts, prices, treaties, or any other written commitments. Competition for the world's oil exports will henceforth increase more in the densely populated less-developed-countries (LDC) than in the industrial world.

HCN#2000/4-1-1
October 2000

All Hubbert Center Newsletter views are those of the individual authors and
are not necessarily those of CSM or its Petroleum Engineering Department


WORLD OIL SUPPLY - IMPORTS
FIGURE 1
WORLD OIL SUPPLY - EXPORTS
FIGURE 2
NOTE: VERTICAL SCALE OF THIS (40,000) GRAPH IS 20 TIMES THAT OF USUAL (2000) CSM/HC GRAPHS.
MILLION BARRELS OIL PER DAY = MMBOD
BILLION BARRELS OIL PER YEAR = BBOY
WORLD OIL PRODUCTION
OIL CONSUMED INTERNALLY
WORLDWIDE ENERGY CONSERVATION
EAST EUROPE
OTHER
WEST EUROPE
JAPAN
USA
IMPORTS
OPEC
NON-OPEC
EXPORTS
40,000 MILLION BARRELS
OIL SHOCK-1
OIL SHOCK-2
OIL GLUT
IRAQ/KUWAIT
OIL GLUT PRICE SURGE
PERMANENT OIL SHOCK
DIGITAL SEISMIC
WW II
Ref: BP Statistical Review
Includes Crude Oil + NGL

HCN#2000/4-1-2

The first economic law of supply versus demand applies particularly well to the ubiquitous, all-essential crude oil where the 1999 global consumption of its products was 72 million barrels/day (MMBD) or 26.2 billion barrels per year (BBY) (= 1 trillion = 1 million-million gallons/year.) Total 1999 global exports were 40.3 MMBD = 55% of the total consumption. Annual global Imports should equal Exports except for the varying amounts of oil held in stock tanks. The U.S. in 1998 imported 8.5 MMBD of crude oil and 1.9 MMBD of refined petroleum products (e.g. gasoline, etc.) for total imports of 10.7 MMBD. This was 58% of the total U.S. liquid fuels consumption.

Non-OPEC Oil Supplies

Many analysts assume that the "non-OPEC" oil producing countries will always be able to make up any temporary shortage in U.S. oil supplies that previously came from OPEC nations such as Iraq or Kuwait, thereby keeping prices down. Unfortunately there is no good long-term evidence for such wishful thinking. Non-OPEC nations consume most or all of their oil production (e.g. USA, UK, China, Brazil, etc.)

World's Oil Producing Countries

The 1998 world comprised a total of 193 countries (including 14 + Russia in the FSU.) Of these, 77 produce crude oil, leaving 116 nations in the non-oil category. Of the oil-producing countries, 41 (like U.S., China, Australia, Brazil) consume all of the crude oil that they produce and must import additional oil and its products as needed. Each of the 157 oil-importing nations considers their local needs as paramount in the world! Only 36 nations are net oil exporters (Table 1), of which 11 are members of the Organization of Petroleum Exporting Countries (OPEC), and the other 25 are "Non-OPEC". Only three of these non-OPEC exporters have sufficient excess production capacity to make any practical difference in any emergency. Nine OPEC plus three non-OPEC nations control the bulk of the world's exports of crude oil and its products. These are: Saudi Arabia, Kuwait, Iraq, Iran, UAE, Venezuela, Libya, Algeria, Nigeria, Russia/FSU, Norway, and Mexico. Russia now produces 82% of the FSU/Ex-USSR oil production. Statistics commonly include the FSU because users are more familiar with the old regional term than to list the other 14 individual nations that produce the other 18% of the FSU's oil.

World's Oil Exporting Countries

Table 1 summarizes the oil exports for the 36 nations that exported crude oil or its products in 1999. The 36 exporting countries are broken down into 11 OPEC (23.5 MMBD);
FSU = 5 exporters (4.6 MMBD); and 20 OTHER (12.2 MMBD) for Total World Exports = 40.3 MMBD. Fifty-six percent of the world's 1999 oil production was exported.

A number of the countries with small 1999 exports may change to net importers if/when their internal population and consumption go up or their production declines.

Major OPEC Countries

The six "Major" OPEC nations include the five "Gulf OPEC" nations surrounding the Persian/Arabian Gulf, plus Venezuela in South America. These six nations produced 46% of the world's exports in 1999. They include: Saudi Arabia, Kuwait, Iraq (under a U.N. embargo which restricted oil exports from 1991 to 1996), Iran, U.A.E., and Venezuela.

Minor OPEC Countries

The five "minor" OPEC nations include Qatar, Libya, Algeria, Nigeria, and Indonesia. These "minor-OPEC" nations produced 13% of the world's oil exports in 1999. Indonesia and Nigeria both have large populations when compared to the other arid/desert "major-OPEC" nations. Saudi Arabia and Iran have the largest domestic oil consumption (each at 1.2 MMBD) of the OPEC states.

It should be expected that other Muslim oil-producing countries (like Oman, Syria, Yemen, and the FSU's Muslim/Caspian states) might join OPEC in the future – either officially or in actions.

Table 1 – WORLD OIL EXPORTERS - 1999

OPEC	MMBD
Saudi Arabia	7.3
Venezuela	2.6
Iran	2.4
U.A.E.	2.2
Iraq	2.1
Kuwait	1.8
Nigeria	1.7
Libya	1.2
Algeria	1.1
Qatar	0.7
Indonesia	0.4
OPEC	23.5

FSU	MMBD
Russia	3.7
Kazakhstan	0.5
Azerbaijan	0.2
Turkmenistan	0.1
Uzbekistan	0.1
FSU/Ex-USSR	4.6

OTHER	MMBD
Norway	3.0
Mexico	1.8
U.K.	1.2
Oman	0.9
Canada	0.8
Angola	0.8
Colombia	0.6
Malaysia	0.4
Argentina	0.3
Gabon	0.3
Syria	0.3
Yemen	0.3
Egypt	0.3
Ecuador	0.3
Congo (Braza.)	0.3
Brunei	0.2
Trinidad	0.1
Vietnam	0.1
Cameroon	0.1
Papua-New Guinea	0.1
OTHER	12.2

Totals may not add due to independent rounding
s = less than 0.05 MMBD

Total 1999 global oil production = 71.9MMBD
Total 1999 global oil exports = 40.3MMBD

Non-OPEC Market Economies

The FSU (now 15 nations) is included in the "Non-OPEC" countries by many workers. It is separated for convenience in Colorado School of Mines (CSM)/Hubbert Center studies. The Former Soviet Union (FSU) is also referred to as the Commonwealth of Independent States (CIS) or the Ex-USSR. The FSU oil production dropped from 12.3 MMBD in 1989 to 7.2 MMBD in 1996, a drop of 42% in seven years. Russia has apparently maintained its exports at a steady level by reducing the amount of oil now used for internal consumption. FSU statistics are not always reliable; the FSU (and China's) claimed oil reserves have not changed since 1990.

China: China's first major oil field, Daqing, was discovered in Manchuria in 1958. Until the field was brought on production in 1969, China's oil consumption was negligible. Their economy took off after 1970 as local oil production zoomed. China exported oil from 1971-92, but resumed importing oil after 1993 when its internal demand exceeded their production. China concedes that their national oil resources are limited, as evidenced by their investments in oil production and pipelines outside of China. The modernizing China, with its huge population, will be a major competitor to the industrialized nations when bidding for oil from the Persian Gulf and Caspian Sea countries.

Mexico is a special case of great interest to the adjoining U.S. Mexico is one of the four main sources of U.S. oil imports (Venezuela, Canada, Saudi Arabia, Mexico). Whether Mexico is "superoily", as suggested by Petroleos Mexicanos' (PEMEX) "hydrocarbon reserve" claims, or merely "oily" as indicated by its production records, is the key question. In 1999 Mexico consumed 53% of its crude oil production of 3.3 MMBD.

Canada's net "oil" exports (0.8 MMBD) to the U.S. depend critically on the volume of Natural Gas Liquids (NGL) produced as an annual by-product of its natural gas production and from its "Tar Sands". The Albertan Tar Sands provide Canada with a long-term cushion for its oil needs/exports. The giant Newfoundland Atlantic Hibernia offshore field (discovered 1979) has finally been put on production. Canada exports oil to the U.S. in the west, while importing oil in the east from Venezuela. The Hibernia field production is expected to reduce imports from Venezuela.

Summary

Superoily nations are crucial for long-term global oil supply plans.

Giant oil fields (those with Estimated Ultimate Recovery/EUR of 0.5 BBO or more) are critical for any nation's production because they commonly produce for 50 years or more. The world's 370 known giant oil fields contained 75% of all oil discovered through 1985. Few giant fields have been discovered since 1985. The 35 giant non-OPEC market economy oil fields discovered during the 1960s and put on stream during the 1970s in the North Sea, Arctic Alaska, etc. cushioned the 1970s oil shocks, but after 25 years these giant oil provinces have begun their production declines. There are, unfortunately, few producible new giants in reserve to replace them, so non-OPEC oil production can be expected to slump within the foreseeable future.

For national security, every country tries to diversify its sources of oil supplies. Virtually all crude production in non-OPEC market economies is already committed to internal or foreign customers, with little surplus in sight for newcomers.

Americans have no inalienable right to buy and consume other nation's oil and gas.

All governments should seriously plan for the foreseeable future oil supply crisis around year 2010.

****

References

1. U.S. Department of Energy / Energy Information Administration, 1997; International Energy Annual 1998; Publ. DOE/EIA-0219(98), Jan. 2000.
2. British Petroleum Co., 2000; BP Statistical Review of World Energy, Jan. 2000.
3. Ivanhoe, L.F., 1990; Competition increases to obtain oil imports; Oil & Gas Journal Oct. 29, 1990, p. 52-54.
4. ---------- 1995; Future world oil supplies: There is a finite limit: World Oil, Oct. 1995, p. 77-88.
5. ---------- 1996; Updated Hubbert curves analyze world oil supply; World Oil, Nov. 1996, p. 91-94.
6. ---------- 1998; Petroleum positions of Ex-USSR and China; CSM/Hubbert Center Newsletter, #98/3, July 1998. (http://hubbert.mines.edu)
7. ---------- 2000; World's Oilfields by Sizes; CSM/HCN#2000/1-2-1; Jan. 2000.
8. Campbell, C. J., 1997; The Coming Oil Crisis, 210p. MultiScience Publishing Co. Ltd. & Petroconsultants, Essex CM14 4RX, England.

HCN#2000/4-1-5

PETROPHOBIA

by
Joseph P. Riva

Crude oil is unpleasant to have around. When spilled in quantity, it kills birds and other living things and generally makes an unsightly mess. However, oil is a natural substance which nature creates and then spills in enormous quantities over time. Oil is generated at depth from organic material and slowly migrates to the surface, resulting in oil seeps, tar pits, and tar lakes. At the surface, the oil is oxidized and eventually completely broken down, a process that provides nutrients to a variety of organisms. Only in rare circumstances is the migrating oil trapped at depth and thus made available for exploitation by the drill.

In spite of the fact that oil has been a natural constituent of the environment for a billion years, existing alongside evolving animals and plants, there is a widespread dread of the substance. In response, politicians in the United States have used various means to ban oil drilling in many places both on and offshore. Unfortunately, some of the areas under such drilling moratoria have significant oil potential. Such policies would appear to indicate that there is no great need for domestic oil production, and indeed more than half of US oil supply is imported. However, oil shipments from countries of whom we do not approve often are embargoed. It would appear that there is no great need for imported oil, either.

There is a disconnect here. Judging from the crowded highways, Americans like gasoline, at least when it is being guzzled by their SUVs. Considering the girth of many citizens, eating also is a priority, but the Green Revolution is the use of land to turn oil into food. Americans also like jet travel, plastic products and having merchandise shipped via the Internet. The disconnect may reflect an educational problem. Few people have learned to appraise evidence, analyse facts and draw logical conclusions. Gasoline, diesel fuel, herbicides, pesticides, fertilizer, jet fuel, plastics, and a huge number of other useful products are made from that dreadful oil. Last, but perhaps not least, modern warfare is impossible without it. Thus, it is essential that the United States has access to huge quantities of oil, and it has to come from somewhere.

A major oil shortage in the United States would be a catastrophe, ranking just below nuclear war. There is a near total dependency on oil for transportation and food production. If these two industries are severely crippled, the results will be apocalyptic, dwarfing a surely related collapse in an already inflated stock market. With this in mind, it would appear wise to consider the world's oil supply and its dependability, beginning with the United States.

The US once led the world in oil output, but is now a densely drilled, mature producing region in which oil production has been declining for thirty years. In spite of this decline, certain prospective areas have been withheld from exploration, including the continental shelves (except for the Gulf of Mexico), certain parts of the West, and much of Alaska, particularly in a part of

the North Slope that is considered to contain some of the best undrilled oil prospects in the world. There is significant opposition to drilling in any of these regions, for a variety of environmental reasons, most having little scientific validity considering the excellent environmental record of modern drilling operations. However, should an oil supply crisis occur, such emotional opposition likely will be swept aside and the areas explored. Some will be found to be unproductive, as oil accumulations remain a rare and elusive target. More importantly, there is a considerable time lag between the beginning of exploration and production, even in the most prolific areas such as the North Slope. Thus, the oil contribution from the banned areas may be long delayed.

Since domestic oil production will continue to decline, oil imports will have to increase, making it necessary to consider the geological aspects and political reliability of foreign oil sources. Most of the world's oil reserves are located in the Middle East, a region with a history of wars, illegal occupations, coups, revolutions, sabotage, terrorism, and oil embargoes. To these possibilities may be added growing Islamist movements with various antipathies towards the West, and particularly to the United States because of its perceived political tilt toward Israel.

In addition, and perhaps more importantly, reported levels of proved Middle East oil reserves are suspect. Some credible reserve estimates are less than half the published amounts. If these lower estimates prove to be correct, the consequences will be enormous because the time during which world oil production will be able to satisfy current demand would be very short. What follows would be a prolonged decline in world oil availability, a situation that would only worsen over time.

There will not be much help from the rest of the world. For many years, much less oil has been discovered in new fields worldwide than has been produced. Tar sands and oil shales, often mentioned as a substitute for conventional oil, have to be mined and extensively processed before utilization. The entire operation is complicated, expensive, and produces relatively little oil compared to the effort expended. Much worse, however, is the high-energy cost. After drilling, blasting, loading, hauling, grinding, heating, and waste disposal, net energy recovery is quite low.

The spectacular performance of the US economy is the result of free enterprise optimism, but it is powered by oil, billions of barrels of it. Oil is the Achilles heel of Western civilization, and this is particularly true for the United States. Great quantities of oil have to keep coming, or the US and the world economy will collapse. Oil is finite. The world has been almost entirely explored for oil, with ever-diminishing results. An oil supply crisis appears inevitable. Only the timing is in doubt. As to possible remedies, obviously research to provide oil substitutes should be encouraged, but also conservation and exploitation should proceed. Regardless of when a supply crisis occurs, oil is too valuable to waste and it is too valuable to leave in the ground. Also, oil is fungible, anyone's will suffice. Sanctions now and a seller with a long memory may favor other customers later. *Petrophobia* is the unreasoned fear of the dreadful oil. But when the dreadful oil becomes scarce, the fear will become real.

HCN#2000/4-2-7

The Author: Joseph P. Riva

After receiving an M.S. in Geology in 1959, J. P. Riva worked as an exploration geologist for the Tenneco Oil Company in the Rocky Mountains. In 1966 he joined the Smithsonian Institution, specializing in energy and water resources research. In 1974 he moved to the Congressional Research Service of the Library of Congress to become a non-partisan congressional advisor on world oil and gas. During 1980 he worked as a senior research geologist with the U.S. Geological Survey in the World Energy Program. He has testified before Congress and has authored more than 200 publications including the Fossil Fuels section of Encyclopaedia Britannica and the following four books: World Petroleum Resources and Reserves (1983), and U.S. Conventional Oil and Gas Production Prospects to the Year 2000 (1985), both from Westview Press; and Exploration Opportunities in Latin America (1992), and Petroleum Exploration Opportunities in the Former Soviet Union (1994) both from PennWell Books. He has served on the Committee on Offshore Hydrocarbon Resource Estimation Methodology and on the Committee on Undiscovered Oil and Gas Resources (National Research Council, National Academy of Sciences) and on the Coordinating Committee of the World Energy Program of the U.S. Geological Survey. He is a member of the AAPG, the AIPG, and Sigma Xi. In 1996 he retired from the Library of Congress and now writes and consults on world petroleum geology.

Joseph P. Riva
9705 Mill Run Drive
Great Falls, VA 22066
703-759-3308
703-759-9295 (fax)

HCN#2000/4-2-8

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 now to 2014. The formation of this center is to encourage a multi-field research approach to this subject.

For further information contact:

Hubbert Center Chairman
Prof. Craig W. Van Kirk
Head of Petroleum Engineering Dept.
Colorado School of Mines
Golden CO 80401-1887
Phone 1-800-446-9488
Fax 1-303-273-3189

Hubbert Center Coordinator
L. F. Ivanhoe
1217 Gregory St.
Ojai CA 93023-3038
Phone 1-805-646-8620
Fax 1-805-646-5506

Internet Address: *http://hubbert.mines.edu*

Notes:
This is one of the Hubbert Center's quarterly newsletters. Please retain for reference.

The views expressed by authors of Center publications are their own, and do not reflect the opinions of Colorado School of Mines, its faculty, its staff, or its Department of Petroleum Engineering.

The Hubbert Center welcomes pertinent letters, clippings, reprints, cartoons, etc.
The Hubbert Center will archive work files of recognized experts in this field.
Contributions to the Hubbert Center through the CSM FOUNDATION INC. are tax-deductible.
Reproduction of any Hubbert Center publication is authorized.