

## M. KING HUBBERT CENTER FOR PETROLEUM SUPPLY STUDIES

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

### PETROLEUM POSITIONS OF EGYPT, LIBYA, ALGERIA, NIGERIA, ANGOLA AFRICA REGION

L. F. Ivanhoe

#### AFRICA

Africa's population of 764 million increased by 163 million (=27%) in the last decade. Africa has 7.0% of the world's claimed oil reserves, and its commercial oil production is restricted to nations along the Mediterranean Sea and West (Atlantic) Africa. The East African countries bounded by the Indian Ocean are not "oily", non-petroliferous.

Table 1: World Petroleum Supply and Disposition

This table is from the U.S. Department of Energy report: International Energy Annual – DOE/EIA-0219(99), Feb. 2001. This compilation combines data from several sources to present the oil Production/Consumption/Imports/Exports of each nation. The table is always a couple of years late due to the complexity of assembling the various data into one table. It allows direct comparison between the several factors for each of the nations of the table or other HC newsletters. The countries covered in this newsletter are underlined. The underlined/graphed nations are the most important oil producers in the region. See Table #1 for other nations' recent oil production/consumption.

**Table 1 World Petroleum Supply and Disposition, 1998**  
(Thousand Barrels per Day)

Region/Country	Primary Supply			Disposition			Bunkers	
	Oil Production <sup>1</sup>	Crude Oil Imports	Total Imports of Refined Petroleum Products	Crude Oil Exports	Total Exports of Refined Petroleum Products	Apparent Consumption (Including Bunkers) <sup>2</sup>	Residual Fuel Oil	Distillate Fuel Oil and Other Products
<b>Africa</b>								
Algeria	1,402	0	2	779	422	206	3	9
Angola	735	0	4	698	7	32	8	8
Cameroon	121	0	2	95	2	25	0	2
Congo (Brazzaville)	265	0	7	257	0	7	1	0
Congo (Kinshasa)	26	2	25	22	7	25	(s)	2
Cote d'Ivoire (Ivory Coast)	21	44	6	9	6	56	1	(s)
Egypt	910	0	48	258	101	572	36	11
Ethiopia	0	0	18	0	0	17	0	(s)
Gabon	353	0	3	336	4	17	1	2
Ghana	5	15	16	0	5	29	0	1
Kenya	1	37	28	0	13	51	1	(s)
Libya	1,450	0	1	1,137	142	175	2	3
Morocco	1	120	25	0	7	144	0	2
Nigeria	2,158	0	45	1,921	2	269	5	2
Senegal	0	17	10	0	2	25	1	4
South Africa	199	321	20	14	68	451	47	4
Sudan	10	5	17	0	0	31	0	(s)
Tunisia	81	19	53	59	13	81	(s)	5
Zimbabwe	0	0	32	0	0	31	0	0
Other	84	54	165	84	3	219	8	20
<b>Total</b>	<b>7,823</b>	<b>635</b>	<b>524</b>	<b>5,669</b>	<b>805</b>	<b>2,463</b>	<b>114</b>	<b>74</b>

<sup>1</sup> Oil production includes crude oil, natural gas plant liquids, other liquids, and refinery processing gains

<sup>2</sup> Apparent consumption includes internal consumption, refinery fuel and loss, and bunkering. Also included, where available, are liquefied petroleum gases sold directly from natural gas processing plants for fuel or chemical uses.

(s)=Value less than 500 barrels per day.

Note: Sum of components may not equal total due to independent rounding.

Energy Information Administration/International Energy Annual 1999: DOE/EIA-0219(99), Feb. 2001

Note: This is one of a series of 7 CSM/HC concise "petroleum position" summaries of the most significant oil producing countries in each of the U.S. DOE/EIA-0219 "regions". Please save for future reference/comparisons of graphs.

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JULY, 2001

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Country Oil Summary

GEOGRAPHY, HISTORY, POLITICS

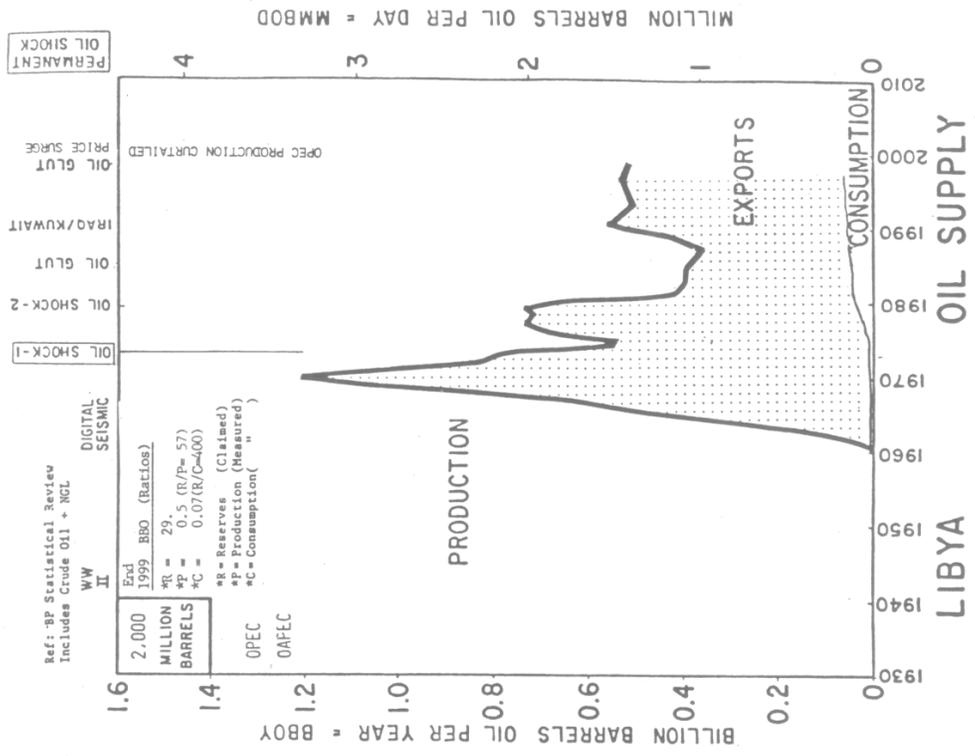
Country: EGYPT Region: Mediterranean AFRICA Figure No. 1 (scale=2K)  
 Population: ( 1999 ) 63 millions Main Language/Religion Arabic / Sunni Muslim  
 Independence: ( 1922 ) from Britain Current political status: Parliamentary / Republic  
 Major Social Turmoil: ( 1973 ) Yom Kippur War with Isreal; Peace treaty with Israel 1979.

Egypt is about the size of Texas + Oklahoma + Louisiana.  
 Egypt's rapidly growing population (+4%/year 1987-96) is the largest oil consumer of Africa. Egypt is populated along the fertile Nile River, where it flows northward across the desert to the Mediterranean. All of the rest of Egypt is desert. The country is bounded on the north by the Mediterranean Sea, and on the east by the Gulf of Suez / Red Sea and the barren Sinai Peninsula.  
 Egypt is one of the world's oldest civilizations: Egyptian Pharaohs 3000-715 BC.  
 Egypt was conquered by Arab/Muslim armies in 639 AD. It was governed by Muslim Mamelukes 1250-1517 when the Ottoman Turks took over. Napoleon invaded the country briefly in 1798 which began the modernization of Egypt. The Suez Canal was completed in 1869. The British took over Egyptian affairs from 1841-1922, but returned during WW II when the German Afrika Corps threatened Egypt. In 1953 Gamal Nasser ended British control. Egypt fought Israel in 1948, 1967, 1973. Israel occupied the Sinai Peninsula from 1967 to 1982. Sadat was assassinated in 1981 and his V.P. Hosni Mubarak succeeded him as president. Egypt objected strongly to Iraq's occupation of Kuwait in 1990, and joined the UN coalition that defeated Iraq during the Persian Gulf/Desert Storm war.

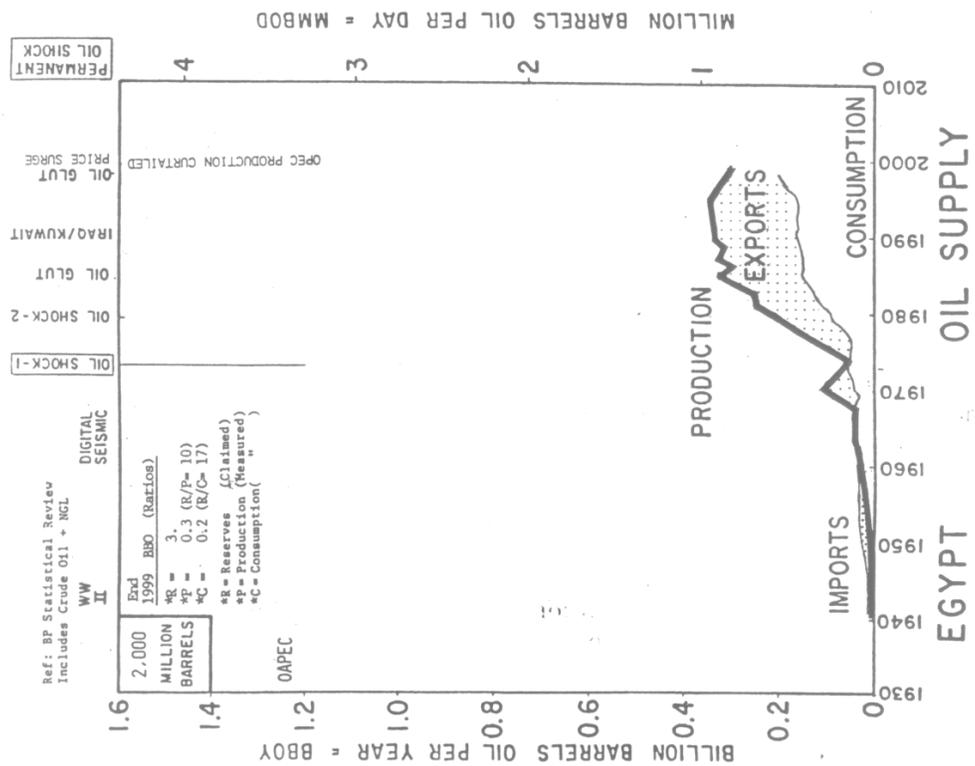
PETROLEUM: EGYPT is gassy & "low "oily":(with 0.3 % of world's COR.)  
 First oil/gas discovery: Onshore ( 1908 ) Offshore: ( 1961 )  
 National oil company formed: ( 1957 ); Name: EGPC Oil Nationalized ( )  
 Joined OPEC: ( - ) OAPEC: ( 1968 )  
 Oil Production: ( 1999 ) 835 MBD Oil Consumption:( 1999 ) 575 MBD  
 Exports:( 1999 ) 260 MBD Imports:( ) - MBD  
 COReserves( 1999 ) 3 BBO; CGR: 35 Tcf. Oil:R/P= 10 yrs;R/C= 17 yrs  
 Hubbert production peak: ( 1993 ) Maximum effort peak: ( - ) EUR: BBO  
 Non-conventional oil prod.( ) - MBD; "Other" oil prod. ( ) - MBD

Egyptian oil & gas production comes from: (A) Western Egypt Desert; (b) Offshore Gulf of Suez; (C) Nile Delta.  
 Minor oil was discovered in Egypt in 1908 and by 1940 production reached 18 MBD – the only pre-WW II oil production in Africa. After the 1967 Israel/Arab war, Israel occupied the Sinai Peninsula and the eastern Gulf of Suez offshore oil fields – which production the Israelis increased. The Sinai and the eastern Gulf of Suez oil fields were returned to Egypt in 1975-1982 after the Yom Kippur war. Egyptian oil production peaked in 1993 at 945 MBD.

References: (1) BP Statistical Review (annual); (2) DOE/EIA-0219 (annual); (3) CSM Hubbert Center Newsletter: HCN# _____	Ivanhoe Date: <u>4/13/01</u> Rev: _____
Ref (1): Oil Production = crude oil + oil sands + natural gas liquids. BP = British Petroleum; O&GJ = Oil & Gas Journal; ( ) = year; MBD = 1,000 Barrels/Day; Reserves = (end year)from BP/O&GJ; OPEC = Organization of Petroleum Exporting Countries; OAPEC = O-Arab-PEC. BBO = Billion Barrels Oil; Tcf = Trillion cubic feet gas; COR = Claimed Oil Reserves; CGR = Claimed Gas Reserves; EUR = Estimated Ultimate Recovery-BBO. e = estimated. R/P = COR/Production; R/C=COR/Consumption	_____ _____ _____



IVANHOE FIGURE 2



IVANHOE FIGURE 1

Country Oil Summary

**GEOGRAPHY, HISTORY, POLITICS**

Country: LIBYA Region: Mediterranean AFRICA Figure No. 2 (scale=2K)  
 Population: ( 1998 ) 6 millions Main Language/Religion Arabic/Sunni Muslim  
 Independence: ( 1951 ) from Italy Current political status: Socialistic Dictatorship  
 Major Social Turmoil: ( 1969 ) Military coup – King Idris overthrown by Col. Qaddafi

Libya is slightly larger than Alaska + Oklahoma. It is bounded on the north by the Mediterranean Sea – between Egypt and Tunisia/Algeria. On the south is the Sahara Desert which reaches the Mediterranean in mid-Libya at the Gulf of Sirte. The region is infertile, and as a result was never colonized by anyone until the Italians invaded in 1911. During the 1920s and 1930s, the Italians sponsored many improvements as a colony. During WW II fierce fighting took place along the coastal highway between the British and Italians and later between the British and the German Afrika Corps. In 1951, the UN called for the independence of Libya which became a kingdom. Oil was discovered in 1957 which changed Libya from poverty to riches. King Idris was overthrown by Col. Qaddafi in 1969. Libya, under its leader – Qaddafi, has a rogue government that is a problem to many foreign governments. The U.S. broke relations with Libya in 1981 and bombed the capital Tripoli in 1986. Britain broke relations in 1984. A UN and Britain oil embargo was lifted in 1999 after Libya turned over to a European court the two Libyan suspects of a 1988 Lockerbie, Scotland plane bombing.

**PETROLEUM:** LIBYA is very “oily”:(with 2.9 % of world’s COR.)

First oil/gas discovery: Onshore ( 1957 ) Offshore: ( 1967 )  
 National oil company formed: ( 1968 ); Name: Lipetco Oil Nationalized ( )  
 Joined OPEC: ( 1962 ) OAPEC: ( 1968 )  
 Oil Production: ( 1999 ) 1,425 MBD Oil Consumption:( 1998 ) 198 MBD  
 Exports:( 1999 ) 1,227 MBD Imports:( ) - MBD  
 COReserves( 1999 ) 29 BBO; CGR: 46 Tcf. Oil:R/P= 57 yrs;R/C= 400 yrs  
 Hubbert production peak: ( ) Maximum effort peak: ( ) EUR: BBO  
 Non-conventional oil prod.( ) - MBD; “Other” oil prod. ( ) - MBD

The small population consumes only a minor fraction of the nation’s oil production, which is the most important export.

Libyan basins include: Sirte; Murzuk; Ghadames; Kufra; Cyrenaica.

Major oil production comes from several “GIANT” (EUR=+500 MMBO) fields in the onshore Sirte basin in the Sahara Desert. From 1958-1968 (Pre-Qaddafi) 16 major oil fields (75% of Libya’s reserves) were found in the Sirte basin. These fields are now more than 30 years old and are “middle aged”.

References: (1) BP Statistical Review (annual); (2) DOE/EIA-0219 (annual); (3) CSM Hubbert Center Newsletter: HCN# _____	Ivanhoe Date: <u>4/13/01</u> Rev: _____
Ref (1): Oil Production = crude oil + oil sands + natural gas liquids. BP = British Petroleum; O&GJ = Oil & Gas Journal; ( ) = year; MBD = 1,000 Barrels/Day; Reserves = (end year)from BP/O&GJ; OPEC = Organization of Petroleum Exporting Countries; OAPEC = O-Arab-PEC. BBO = Billion Barrels Oil; Tcf = Trillion cubic feet gas; COR = Claimed Oil Reserves; CGR = Claimed Gas Reserves; EUR = Estimated Ultimate Recovery-BBO. e = estimated. R/P = COR/Production; R/C=COR/Consumption	_____

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Country Oil Summary

GEOGRAPHY, HISTORY, POLITICS

Country: ALGERIA Region: Mediterranean AFRICA Figure No. 3 (scale=2K)  
 Population: ( 1998 ) 30 millions Main Language/Religion Arabic/Sunni Muslim  
 Independence: ( 1962 ) from France Current political status: Socialist Republic  
 Major Social Turmoil: ( 1959 - 1998 ) Semi-continuous civil wars between Army & Islamists

Algeria is about the size of Alaska + Texas + Oklahoma.

Algeria is the largest country of Mediterranean Africa and the second largest (after Sudan) in Africa. The Sahara Desert covers four-fifths of Algeria.

Almost all of the people live north of the Atlas mountain range along the fertile Mediterranean coast. This was one of the Roman Empire's sources of wheat (100 AD).

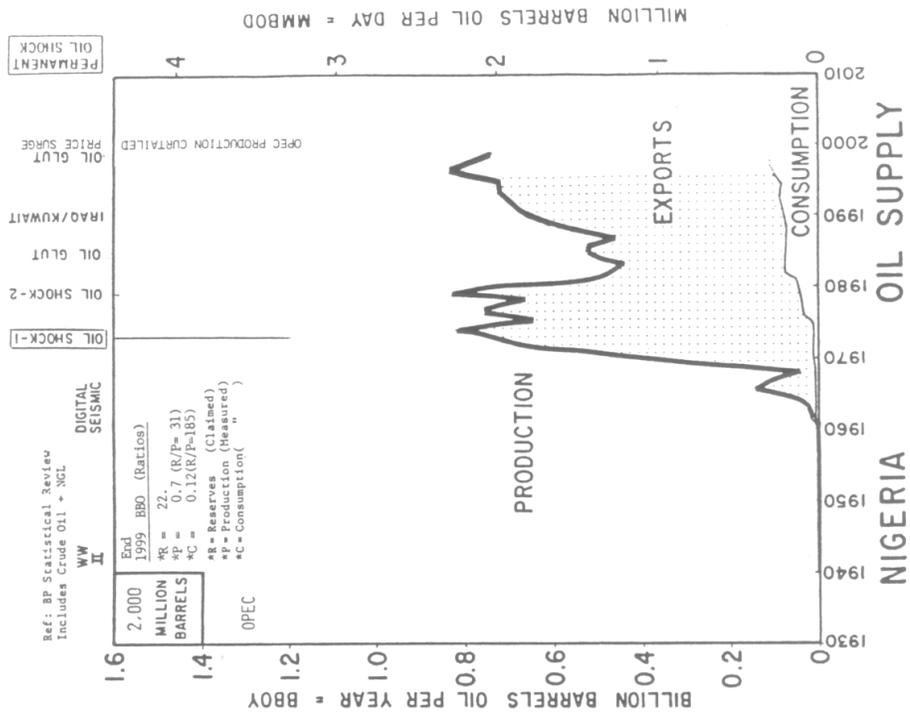
The Arabs/Muslims arrived in 700 AD. The French colonized Algeria from 1830 to 1962 when they were forced to give the nation its independence. Since then Algeria has been plagued by riots and civil rebellions. Rural people have migrated to the cities where a severe housing shortage has resulted in the growth of large slums. Less than 1% of the people are of European descent. Many Algerians have migrated to France. The discovery by the French of large oil and gas fields in 1956 in the Sahara enriched the developing nation. The population increased 2.6% annually from 1987-1996. One third of the food is imported.

PETROLEUM: ALGERIA is gassy & "oily":(with 0.9 % of world's COR.)

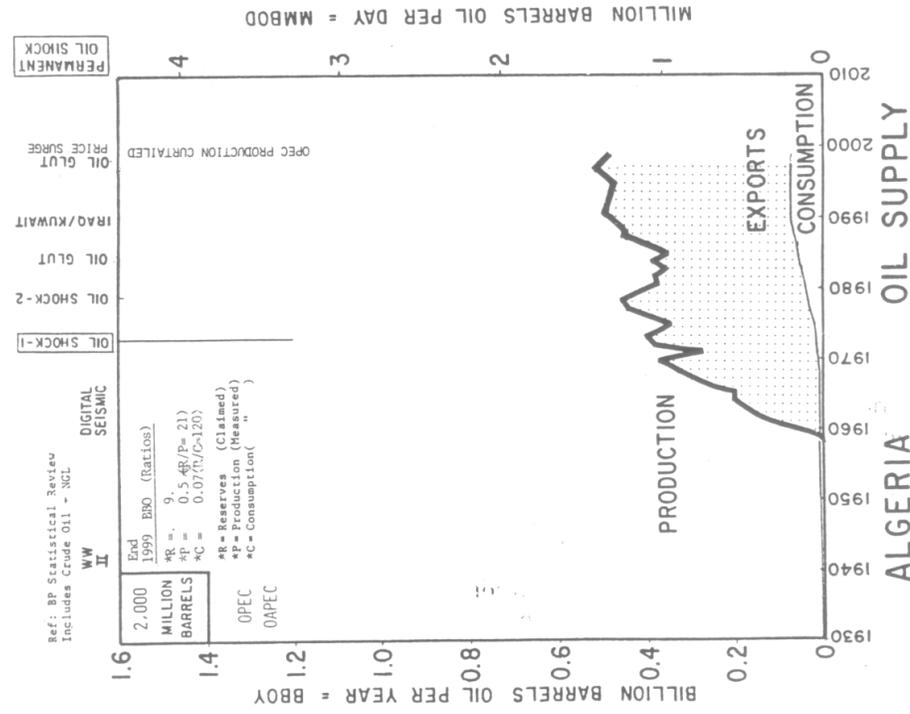
First oil/gas discovery: Onshore ( 1913 ) Offshore: ( )  
 National oil company formed: ( 1963 ); Name: Sonatrach Oil Nationalized ( 1962 )  
 Joined OPEC: ( 1969 ) OAPEC: ( 1968 )  
 Oil Production: ( 1999 ) 1,340 MBD Oil Consumption:( 1999 ) 200 MBD  
 Exports:( 1999 ) 1,140 MBD Imports:( ) - MBD  
 COReserves( 1999 ) 9 BBO; CGR: 160 Tcf. Oil:R/P= 20 yrs;R/C= 120 yrs  
 Hubbert production peak: ( ) Maximum effort peak: ( ) EUR: BBO  
 Non-conventional oil prod.( ) MBD; "Other" oil prod. ( ) MBD

The first Saharan oil and gas fields were found by the French in 1956. Hassi Massoud (a giant oil field) and Hassi R'Mel (gas field) were both discovered in 1956. Oil and gas account for about 90 percent of the total of Algeria's exports. Liquid Natural Gas (LNG) is exported.

References: (1) BP Statistical Review (annual); (2) DOE/EIA-0219 (annual); (3) CSM Hubbert Center Newsletter: HCN# _____	Ivanhoe Date: <u>4/13/01</u> Rev: _____
Ref (1): Oil Production = crude oil + oil sands + natural gas liquids. BP = British Petroleum; O&GJ = Oil & Gas Journal; ( ) = year; MBD = 1,000 Barrels/Day; Reserves = (end year)from BP/O&GJ; OPEC = Organization of Petroleum Exporting Countries; OAPEC = O-Arab-PEC. BBO = Billion Barrels Oil; Tcf = Trillion cubic feet gas; COR = Claimed Oil Reserves; CGR = Claimed Gas Reserves; EUR = Estimated Ultimate Recovery-BBO. e = estimated. R/P = COR/Production; R/C=COR/Consumption	_____



IVANHOE FIGURE 4



IVANHOE FIGURE 3

Country Oil Summary

GEOGRAPHY, HISTORY, POLITICS

Country: NIGERIA (OPEC) Region: West AFRICA Figure No. 4 (SCALE=2K)  
 Population: ( 1998 ) 106 millions Main Language/Religion English / Christian & Sunni Muslim  
 Independence: ( 1960 ) from Britain Current political status: Republic  
 Major Social Turmoil: ( 1967 - 1970 ) Civil War: Biafra/Ibos vs Nigeria over oil money. Military governments

Nigeria is slightly larger than Texas + Oklahoma.  
 Nigeria has the largest population of Africa. Population increased from 1989-1998 was from 85 to 106 = 21 million. The climate and vegetation changes rapidly from the humid tropical plants at the Atlantic Ocean coast to the dry Saharan Desert on the north. There are more than 250 different ethnic groups, but the three largest (Hausa, Yoruba, Ibo/Igbo) account for 60% of the population. Migration of farmers into the cities since the 1960s have resulted in extensive slums. Nigeria is an economically developing country, (LDC). The northern/Saharan states are Muslim, whereas the southern tropical states are Christians. The oil & gas fields are all located in the Niger River delta. The local (Ibo) tribes of the delta have revolted several times to protest the lack of sharing of the delta's oil income with them by the Federal (Muslim) government and Army.

PETROLEUM: NIGERIA is very gassy "oily":(with 2.2 % of world's COR.)  
 First oil/gas discovery: Onshore ( 1956 ) Offshore: ( 1964 )  
 National oil company formed: ( 1971 ); Name: NNOC Oil Nationalized ( )  
 Joined OPEC: ( 1971 ) OAPEC: ( - )  
 Oil Production: ( 1999 ) 2,030 MBD Oil Consumption:( 1998 ) 325 MBD  
 Exports:( 1999 ) 1,705 MBD Imports:( ) - MBD  
 COReserves( 1999 ) 22 BBO; CGR: 124 Tcf. Oil:R/P= 31 yrs;R/C= 185 yrs  
 Hubbert production peak: ( ) Maximum effort peak: ( ) EUR: BBO  
 Non-conventional oil prod.( ) - MBD; "Other" oil prod. ( ) - MBD

All of Nigeria's petroleum production is from the Niger Delta onshore and offshore, where several "Giant" (EUR= +0.5 BBO) fields have been discovered. Basement rocks or thin sediments cover the rest of Nigeria. An oilfield was discovered 1979 in Chad near the NE corner of Nigeria. Petroleum provides 90% of Nigeria's exports. Nigeria's internal consumption is negligible (16%) when compared to the nation's total oil production.

References: (1) BP Statistical Review (annual); (2) DOE/EIA-0219 (annual); (3) CSM Hubbert Center Newsletter: HCN# _____	Ivanhoe Date: <u>4/13/01</u> Rev: _____
Ref (1): Oil Production = crude oil + oil sands + natural gas liquids. BP = British Petroleum; O&GJ = Oil & Gas Journal; ( ) = year; MBD = 1,000 Barrels/Day; Reserves = (end year)/from BP/O&GJ; OPEC = Organization of Petroleum Exporting Countries; OAPEC = O-Arab-PEC. BBO = Billion Barrels Oil; Tcf = Trillion cubic feet gas; COR = Claimed Oil Reserves; CGR = Claimed Gas Reserves; EUR = Estimated Ultimate Recovery-BBO. e = estimated. R/P = COR/Production; R/C=COR/Consumption	_____

HC#2001/3-1-7

Country Oil Summary

GEOGRAPHY, HISTORY, POLITICS

Country: ANGOLA Region: Atlantic AFRICA Figure No. 5 (scale=2K)  
 Population: ( 1998 ) 12 millions Main Language/Religion Portuguese/Bantu – Christian/Animist  
 Independence: ( 1975 ) from Portugal Current political status: Republic  
 Major Social Turmoil: ( ) Semi-continuous civil wars since 1961

ANGOLA is on the southwestern coast of Africa on the South Atlantic Ocean. Most of it is south of the Congo/Zaire River. Northern Angola (Cabinda territory) is tropical, but the country dries up towards the south, becoming steppe/desert at the southern (Namibia) border. The Angolan seacoast was discovered by the Portuguese sea captain Diogo Cao in 1483. Portuguese traders and managers moved into Angola from the late 1920s until the first native revolts in 1961. Rebellions continued until independence was granted in 1975 when many Portuguese left Angola. The MPLA group was eventually sponsored by the USSR and Cuba, while the UNITA rebels were aided by South Africa forces from Namibia. The MPLA set up a marxist government in 1976 which lasted until 1991 when the Cuban soldiers left after a cease fire was agreed upon. MPLM won an election in 1992, but the UNITA rebels objected to the results and resumed fighting. UN peace keepers arrived in 1995.

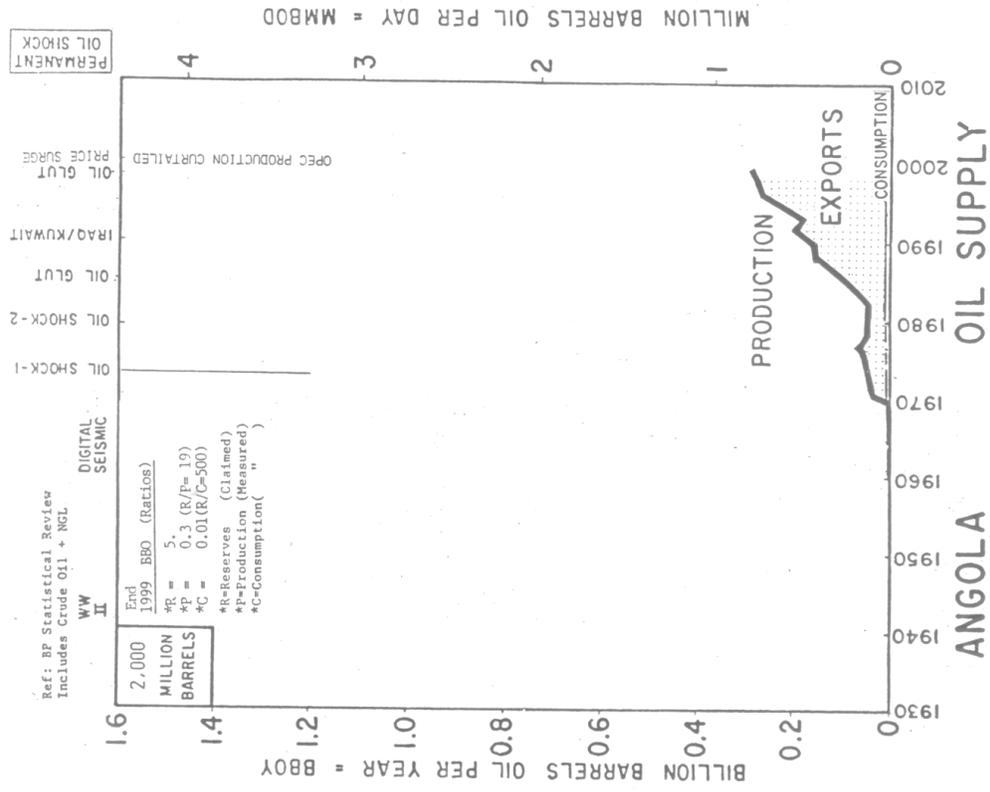
PETROLEUM: ANGOLA is \_\_\_\_\_ “oily”:(with 0.5 % of world’s COR.)

First oil/gas discovery: Onshore ( 1955 ) Offshore: ( 1975 )  
 National oil company formed: ( ) Name: Sonangol Oil Nationalized ( )  
 Joined OPEC: ( - ) OAPEC: ( - )  
 Oil Production: ( 1999 ) 780 MBD Oil Consumption:( 1998 ) 32 MBD  
 Exports:( 1999 ) 748 MBD Imports:( ) - MBD  
 COReserves( 1999 ) 5.4 BBO; CGR: 1.6 Tcf. Oil:R/P= 19 yrs;R/C= 450 yrs  
 Hubbert production peak: ( - ) Maximum effort peak: ( - ) EUR: BBO  
 Non-conventional oil prod.( ) - MBD; “Other” oil prod. ( ) - MBD

Petroleum and diamonds are Angola’s leading exports. Oil production began in 1960 and increased in 1970. Since 1982, offshore production off CABINDA has steadily increased. The northernmost territory of Cabinda is separated from the rest of Angola by the sliver of the country of CONGO (Kinshasa) which breaks through to the coast along the Congo/Zaire river. Several giant fields in ultra -deep water have been found in the Atlantic Ocean waters since 1996, but few have yet been put on production. This African South Atlantic Ocean deep water region which extends northwards, has the potential to become a Major (EUR=7-25 BBO) new oil province.

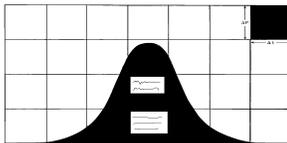
References: (1) BP Statistical Review (annual); (2) DOE/EIA-0219 (annual); (3) CSM Hubbert Center Newsletter: HCN# _____ O & G J: 1/18/99, p. 33-38	Ivanhoe Date: <u>4/13/01</u> Rev: _____
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HC#2001/3-1-9

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  
Internet Address: <http://hubbert.mines.edu>

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

Notes:

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## The Oilman's Column #8 - by L. F. Ivanhoe

### A. RECOGNITION OF THE HUBBERT PRODUCTION PEAK

King Hubbert succinctly described how an ideal annual production curve of a finite resource (like oil) starts at zero, rises to a peak (Hubbert Peak = HP) and then declines to zero. However, such an idealized Hubbert Curve (HC) is recognizable in few petroleum provinces/countries. Good Hubbert Curves appear for the US/48 and the former USSR countries where oil production is restricted by pipelines. These areas show a local production "plateau" instead of a definite "peak" production. "Peaks" and "plateaus" can be erratically interrupted by anything that curtails the local oil production. Such factors include: Pipeline breaks, wars, politics, economics/prices, accidents, OPEC quotas, technological changes, etc. The feuding Persian Gulf OPEC giants' production (HCN #2001/1) show several erratic "lows" and "peaks". A common surge occurred offshore during the 1970s after the introduction of digital seismic methods. (See: Hubbert Center Newsletter (HCN) national production graphs: HCN #98/1; 98/3; 99/3; 2000/2; 2001/1; 2001/3.) A small "final" Maximum Effort Peak surge may follow the Hubbert Production Peak (HPP) in countries where local operations increase temporarily with high oil prices. (See 1998 USSR = HCN #98/3; HCN #2000/1; 1985 USA = HCN #98/1.) In short, it is difficult to identify most nations' HPP among all of the associated "noise".

### B. DATE OF THE HUBBERT PRODUCTION PEAK IS PRODUCTION DEPENDENT

It is possible in some cases to project the approximate date of a nation's HPP if good records exist on the date/size of the nation's oil discoveries and the local Hubbert Discovery Peak (HDP). If the nation's annual oil production is plotted on the same production graph as the local oil discoveries, definite limits can be placed on the start of the local oil production decline. (See: HCN #96/1 graph of World Oil Supply.) It is axiomatic that total local oil production cannot exceed the local discoveries, so the total AREA under the "production curve" cannot be greater than the total area under the "discovery curve". (The graph's scale is indicated by the 100Bbo = 10Bby x 10 years square in the upper right corner of HCN #96/1 Fig. 3 and the 2,000 million barrels rectangles in the upper left corner of most HC oil supply graphs.)

The critical factor that determines the DATE of the HPP is NOT the possible oil RESOURCES that theoretically exist, but the VOLUME of oil that the local petroleum engineers (P.E.s) are able to produce at the critical DATE. Consequently, the limitation will be a P. E. FACT rather than a geologist's number. HPP TIMING IS CRUCIAL!