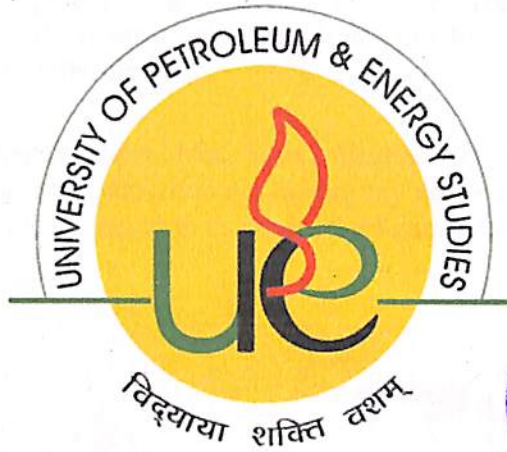


UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
DEHRADUN



Harnessing Energy through Knowledge

Dissertation

African Crude Potential in India

Under Supervision of:

Prof. S.K.Pokhriyal

(Head of Department)

REFERENCE COPY

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I express my gratitude to my teachers, Ms. Sonal Gupta and Ms. Somya Sharma for the constant support and guidance they provided me during my entire report tenure. Inputs provided by them to be proved highly instrumental in the successful completion of my project.

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BONAFIDE CERTIFICATE

This is to certify that Ms. Rhythm Minhas, student of University of Petroleum and Energy Studies, Dehradun, pursuing MBA(Energy Trading), has successfully completed her dissertation project. As a part of her curriculum, the project report entitled, “**African Crude Potential in India**” submitted by student to the undersigned in an authentic record of her original work which she has carried out under my supervision and guidance.

I wish her all the best.

Prof. S.K. Pokhriyal

Head of Department - Oil and Gas

College of Management & Economic Studies

University of Petroleum & Energy Studies

CERTIFICATE OF ORIGINALITY

This is hereby state – with the intention of this report is very original in every sense of the terms and conditions and it carries a sense of honor and belief and that no shortcuts have been taken and I remain both meticulous and caring during the relevance of this research work. I have put in my point best to keep this work as informative and precise as possible.

It may be also stated here that during the preparation of this report some help has been taken from a scope of professionally shared information and knowledge, a comprehensive description has been mentioned in the reference chapter of this report.



RHYTHM MENHAS

25/04/2014

ABSTRACT

Energy is the need of every country. Irrespective of a country, whether developed or developing, energy is the need of the hour. Developed countries need energy for continuing their steady growth and maintaining the desired production rate whereas developing countries need energy for sustainable production, increasing their growth rate and meeting the daily energy demands.

Disruptions in the supply could prove hazardous to a country's health and growth rate. So a country should always have alternatives ready for the disruptions. It should know the various crudes available worldwide and their possible potential in the country.

The project title —African Crude Potential in India is about the overall analysis of the potential of African crude in India.

Africa is the world's second-largest and second-most-populous continent. At about 30.2 millionkm² including adjacent islands, it covers six percent of the Earth's total surface area and 20.4 percent of the total land area¹. The continent is surrounded by the Mediterranean Sea to the north, both the Suez Canal and the Red Sea along the Sinai Peninsula to the northeast, the Indian Ocean to the southeast, and the Atlantic Ocean to the west. The continent includes Madagascar and various archipelagoes. The African Union (AU) is a 54 member federation consisting of all of Africa's states except Morocco.

Although it has abundant natural resources, Africa remains the world's poorest and most underdeveloped continent, the result of a variety of causes that may include the spread of deadly diseases (notably HIV/AIDS and malaria), corrupt governments that have often committed serious human rights violations, failed central planning, high levels of illiteracy, lack of access to foreign capital, and frequent tribal and military conflict (ranging from guerrilla warfare to genocide).

This study consists of three parts. The study contains the introduction of African oil and gas sector on a broader sense. It tells about African oil and gas upstream, midstream as well as downstream business.

The objective of this study is to find out the potential of African crude in India considering the given below factors:

- Crude availability
- Crude quality
- Transportation costs

¹Visual Geography. "Africa. General info"

TABLE OF CONTENTS

1. Introduction.....	1
1.1. Energy Scenario of India.....	2
1.1.1. Oil Scenario.....	3
1.1.2. Ever Increasing Indian Oil Demand.....	4
1.2. Indian Oil and Gas Industry.....	7
1.2.1. The Indian Perspective- Upstream.....	7
1.2.2. The Indian Perspective- Downstream.....	8
1.3. Africa: An Introduction.....	11
1.3.1. Political Scenario.....	12
1.3.2. Economy.....	13
1.3.3. Oil Reserves.....	13
1.3.4. Oil Supply.....	16
1.3.4.1. World Oil Production.....	16
1.3.4.2. Oil Production of Africa.....	16
1.3.4.3. African Oil Exports.....	18
1.3.3. Refining Capacity of Africa.....	19
1.3.4. Highest Crude Oil Producing Countries of Africa.....	24
1.4. Country Profiles.....	25
1.4.1. Nigeria.....	25
1.4.1.1. Introduction.....	25
1.4.1.2. Nigerian Oil Production.....	27
1.4.1.3. Nigerian Oil Consumption.....	27

1.4.1.4. Nigeria Oil Market Overview.....	28
1.4.1.5. Operating Risks Associated.....	29
1.4.2 Algeria.....	29
1.4.2.1. Introduction.....	29
1.4.2.2. Algerian Oil Production.....	31
1.4.2.3. Algerian Oil Consumption.....	31
1.4.2.4. Algeria Oil Market Overview.....	32
1.4.2.5. Operating Risks Associated.....	33
1.4.3. Angola.....	33
1.4.3.1. Introduction.....	33
1.4.3.2. Angola Oil Production.....	36
1.4.3.3. Angola Oil Consumption.....	36
1.4.3.4. Angola Oil Market Overview.....	37
1.4.3.5. Operating Risks Associated.....	37
1.4.4 Libya.....	38
1.4.4.1. Introduction.....	38
1.4.4.2. Libya Oil Production.....	40
1.4.4.3. Libya Oil Consumption.....	40
1.4.4.4. Libya Oil Market Overview.....	41
1.4.4.5. Operating Risks Associated.....	41
1.4.5. Egypt.....	42
1.4.5.1. Introduction.....	42
1.4.5.2. Egypt Oil Production.....	44
1.4.5.3. Egypt Oil Consumption.....	44

1.4.5.4. Egypt Oil Market Overview.....	45
1.4.5.5. Operating Risks Associated.....	45
1.5. Oil Logistics.....	46
1.5.1. Oil Carriers.....	46
1.5.2. Major Oil Trade Routes.....	46
1.5.2.1. Strait of Hormuz.....	48
1.5.2.2. Strait of Malacca.....	49
1.5.2.3. Suez Canal.....	50
1.5.2.4. Bab el Mandeb.....	51
1.5.2.5. Turkish Straits.....	52
1.5.2.6. Panama Canal.....	53
2. Literature Review.....	55
3. Objectives and Need for Study.....	58
4. Research Methodology.....	61
5. Data Analysis.....	62
5.1. SWOT Analysis of Indian Oil and Gas Industry.....	62
5.2. SWOT Analysis: Nigeria.....	63
5.3. SWOT Analysis: Algeria.....	64
5.4. SWOT Analysis: Angola.....	65
5.5. SWOT Analysis: Libya.....	66
5.6. SWOT Analysis: Egypt.....	67
6. Conclusion.....	68
7. References.....	69

LIST OF FIGURES

Figure 1 – Energy Mix of India In 2013.....	3
Figure 2 – Sectored Oil Consumption of India in 2013.....	4
Figure 3 - Production and Consumption of Oil in India.....	5
Figure 4 - Crude Imports of India.....	5
Figure 5 - Estimate of Growing Oil Demand.....	6
Figure 6 - Proved Reserves of India.....	7
Figure 7 - Percentage Share of Refineries in India’s Total Refining Capacity.....	8
Figure 8 - Africa.....	11
Figure 9 – World Proven Oil Reserves.....	14
Figure 10 - African Proved Reserves.....	15
Figure 11 - Proved Reserves of Oil Trend, Africa.....	15
Figure 12 - World Oil Production.....	16
Figure 13 - African Oil Production.....	16
Figure 14 - Oil Supply of Africa.....	17
Figure 15 - African Petroleum Consumption.....	17
Figure 16 - Oil Consumption Trend, Africa.....	17
Figure 17 - African Oil Exports.....	18
Figure 18 - World Refining Capacity 2012.....	19
Figure 19 - Crude Distillation Capacity, Africa.....	20
Figure 20 - Nigeria Oil Production.....	27
Figure 21 - Nigeria Oil Consumption.....	27
Figure 22 - Algeria Oil Production.....	31
Figure 23 - Algeria Oil Consumption.....	31

Figure 24 - Angola Oil Production.....	36
Figure 25 - Angola Oil Consumption.....	36
Figure 26 - Libya Oil Production.....	40
Figure 27 - Libya Oil Consumption.....	40
Figure 28 - Egypt Oil Production.....	44
Figure 29 - Egypt Oil Consumption.....	44
Figure 30 - Major Oil Trade Routes.....	46
Figure 31 - Strait of Hormuz.....	48
Figure 32 - Strait of Malacca.....	49
Figure 33 - Suez Canal.....	50
Figure 34 - Bab el- Mandeb.....	51
Figure 35 - Turkish Strait.....	52
Figure 36 - Panama Canal.....	54
Figure 37 - Estimated Reserves of Crude Oil in India, 2012.....	59
Figure 38 - Research Methodology.....	61

LIST OF TABLES

Table 1 - Indian Refineries.....	9
Table 2 - Nigerian Refineries.....	28
Table 3 - Oil Carriers.....	46
Table 4 - SWOT Analysis of Indian Oil and Gas Industry.....	62

1. INTRODUCTION

Energy is the need of every country. Irrespective of a country, whether developed or developing, energy is the need of the hour. Developed countries need energy for continuing their steady growth and maintaining the desired production rate whereas developing countries need energy for sustainable production, increasing their growth rate and meeting the daily energy demands.

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This study consists of three parts. The study contains the introduction of African oil and gas sector on a broader sense. It tells about African oil and gas upstream, midstream as well as downstream business.

¹*Visual Geography. "Africa. General info"*

1.1. Energy Scenario of India

Energy is universally recognized as one of the most important inputs for economic growth and human development. There exists a strong relation between economic development and energy sources, but on the other hand, the level of economic development has been observed to be dependent on the demand for energy.

In recent years, India's energy consumption has been increasing at a great pace due to population growth and economic development. India ranks fourth in the world in terms of primary energy consumption, accounting for about 4.5%² of the world commercial consumption. Growth of any economy lies on the availability of cost-effective and environment friendly energy demand. Despite the overall increase in energy demand, per capita energy consumption in India is still very low compared to other developing countries.

The use of energy has been a key in the development of the human society by helping it to control and adapt to the environment. Managing the use of energy is inevitable in any functional society. In the industrialized world the development of energy resources has become essential for agriculture, transportation, waste collection, information technology, communications that have become prerequisites of a developed society.

In an effort to meet the demands of a developing nation, the Indian energy sector has witnessed a rapid growth. Areas like the resource exploration and exploitation, capacity additions, and energy sector reforms have been revolutionized.

However, resource augmentation and growth in energy supply have failed to meet the ever increasing demands exerted by the multiplying population, rapid urbanization and progressing economy. Hence, serious energy shortages continue to plague India, forcing it to rely heavily on imports.

²Source - BP Statistical review of world energy 2013

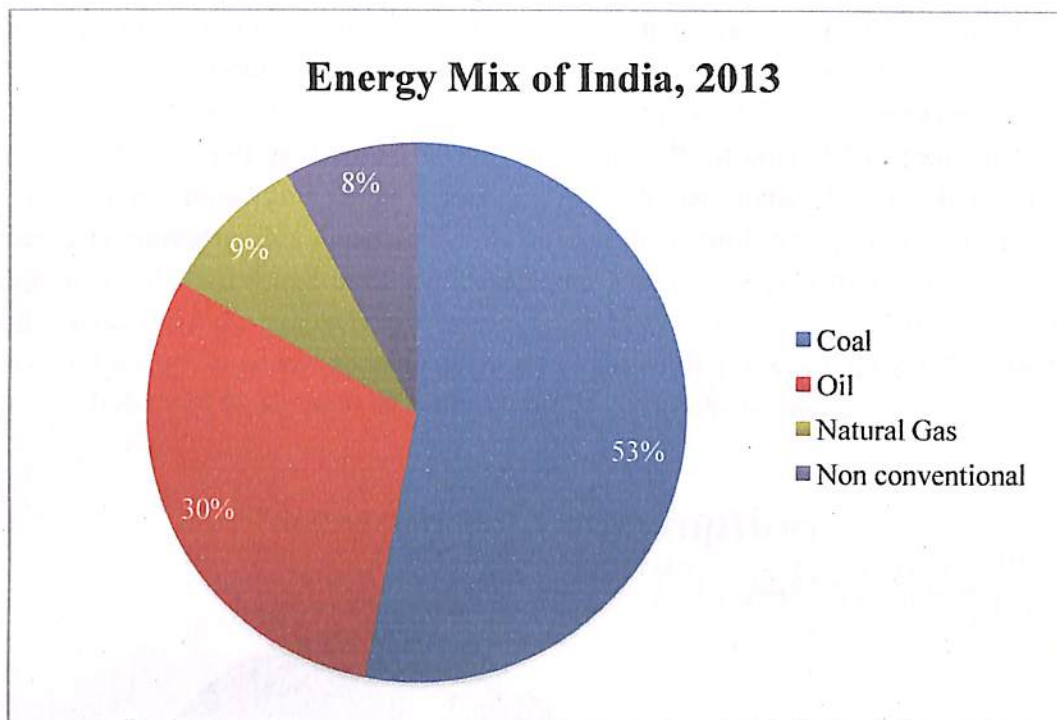


Figure 1³- Energy Mix of India In 2013

India's energy mix has been dominated by coal, accounting to more than half the share. It is followed by oil, which is almost a third of the country's energy mix. Since the report focuses on just the coal aspect, we would be looking at the consumption pattern of coal by various sectors, the demand and domestic production scenario, etc.

In 2012-13, Coal (53% of total Indian demand) remains the dominant source of demand and is the highest since 1996. Oil (30%) remains the second largest fuel used with Coal (9%) and non-fossil fuels (8%) far behind.

1.1.1. Oil Scenario:

Currently at 5th, India will soon become the 3rd largest consumer of oil in the world. The country is guzzling increasing amounts of oil, fueling an economy which is expected to grow at the rate of 5 percent for the next 25 years. , while global oil demand is expected to increase at an annual average rate of 1.6 percent, India's demand for oil is expected to increase at an average rate of 2.9 percent annually till 2030 However, at that point oil will constitute a smaller share of its over- all commercial energy consumption.

There is a huge gap between India's consumption and production of crude oil. With India's domestic production of crude oil being 858,000 bpd, contributing only 1 percent of the world's total oil output, the bulk of India's supply comes from imports. Domestic production is expected

³ BP statistical review 2013

to remain constant, if not decline, over time. There have been a few new discoveries, but production from these fields is merely replacing that of older oilfields which are getting depleted. Thus, while oil is expected to account for a smaller portion of India's energy supply, India is likely to import a greater portion of the oil for its use. With only 0.3 percent of the world's proven reserves and production estimated by the International Energy Agency (IEA) to be less in 2030 than it is currently, this dependence on foreign oil is projected to grow to 91 percent by then. One hears of hopes (and even resigned humor) about the possibility of the discovery of major oil reserves in India some analysts even contend that India sits on a veritable hoard waiting to be tapped. Overall, however, there is acknowledgement that this is improbable— that when it comes to oil, India will likely be a net importer till global reserves run out.

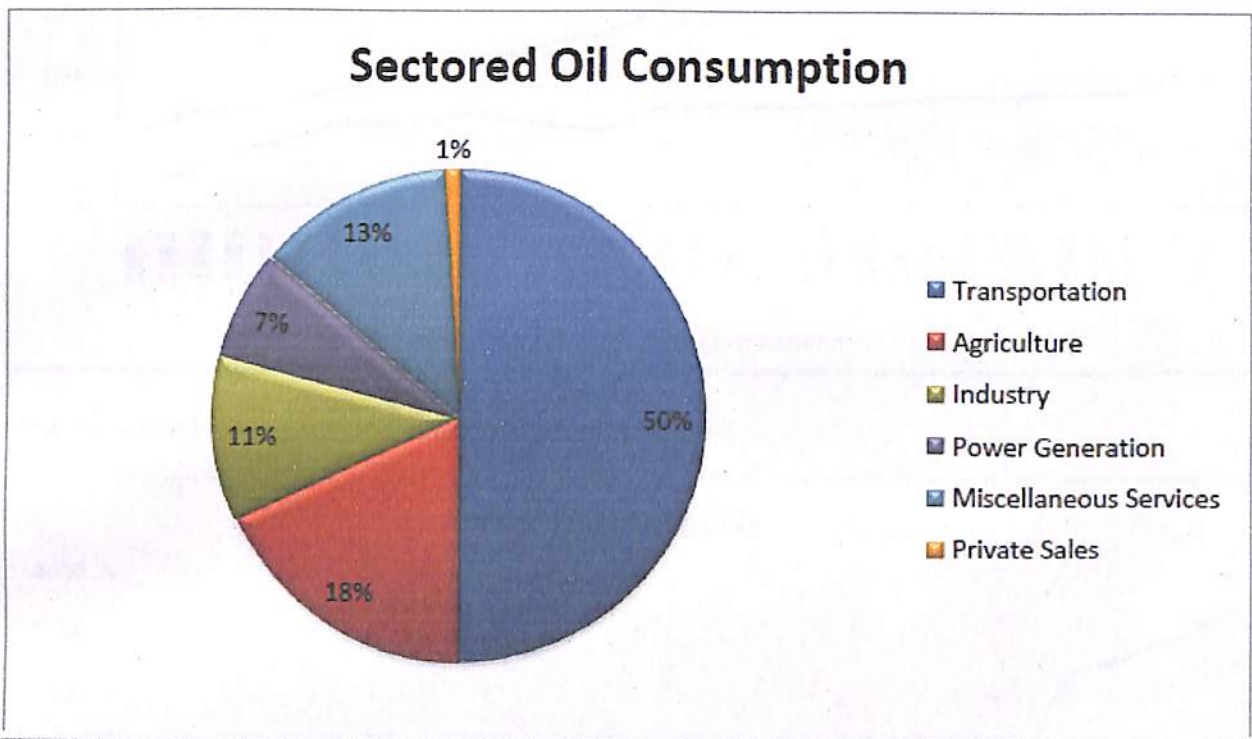


Figure 2 – Sectored Oil Consumption of India

1.1.2. Ever Increasing Oil Demand in India

The demand for crude oil has been ever increasing, but the indigenous production remains more or less the same.

- Also, the sourcing of crude oil has been more or less the same for the past 2-3 decades which makes India all the more vulnerable to supply disruption.
- The country is ill equipped in terms of coping up with price fluctuations and supply disruptions and faces adverse effects to the economy.
- Also, India imports majority of crude from politically unstable countries.

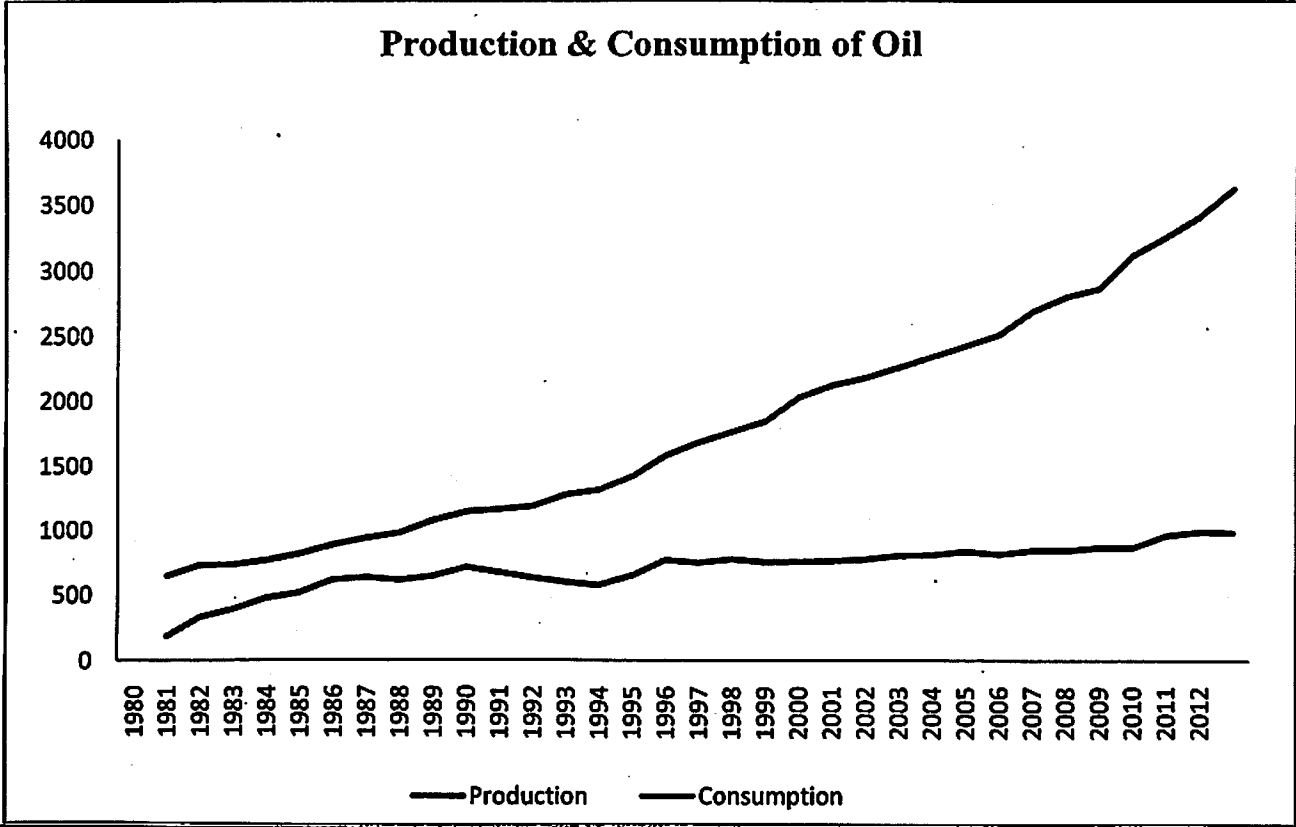


Figure 3 – Production and Consumption of Oil in India

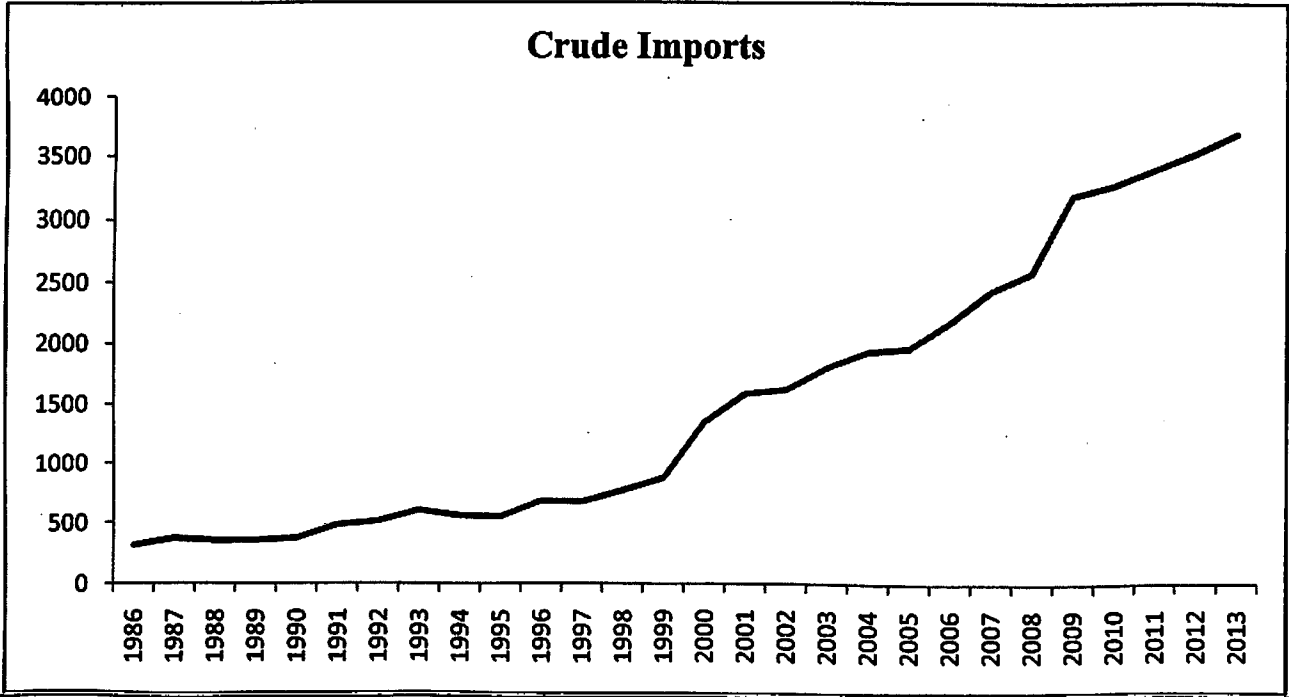


Figure 4 – Crude Imports of India

The US sanctions on Iran had huge pressure on India for import of crude. Apart from Middle-East, India has to look for other options for import of crude. A huge opportunity lies in African crude.

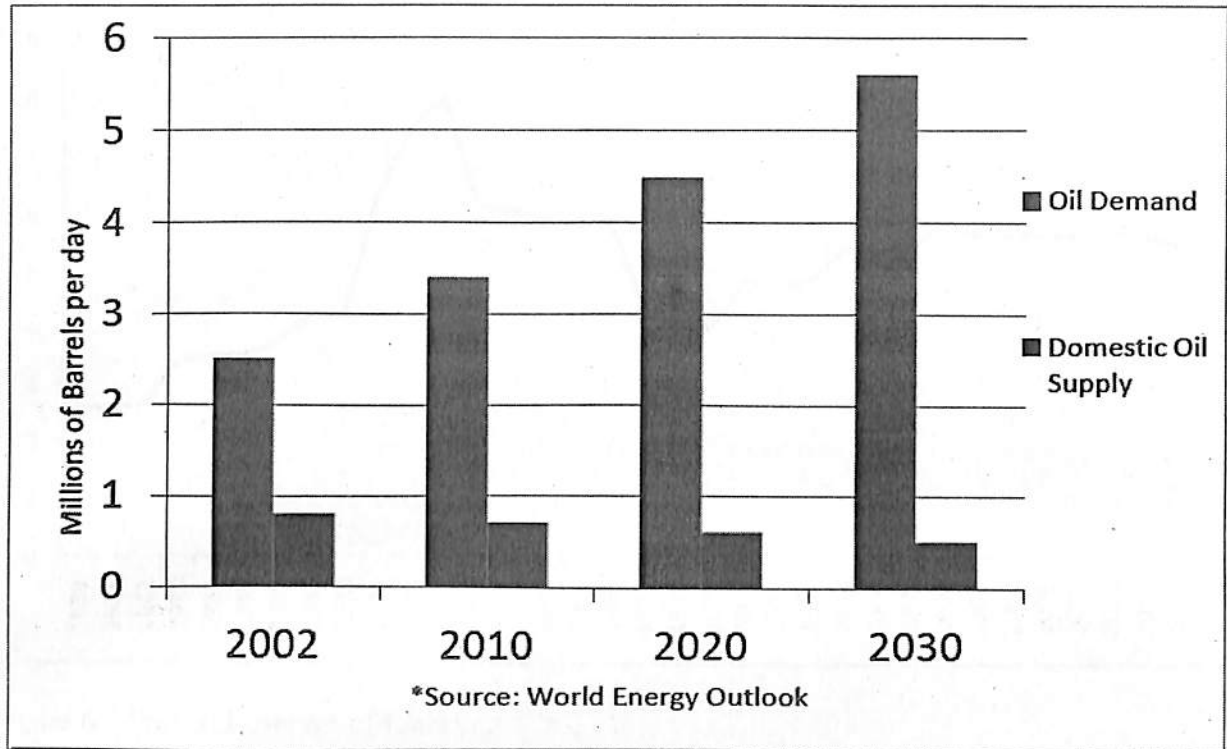


Figure 5 – Estimate of Growing Oil Demand

1.2. Indian Oil and Gas Industry

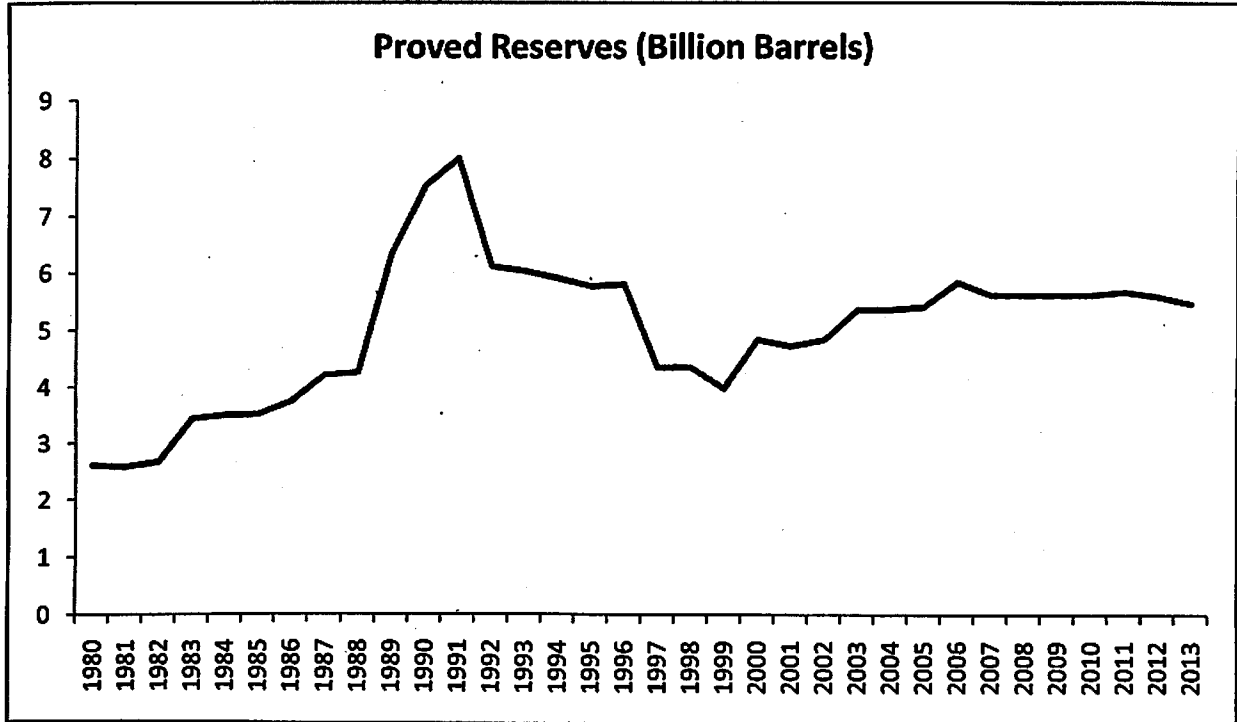


Figure 6 – Proved Reserves of India

1.2.1. The Indian Perspective - Upstream

Oil exploration and production industry in India dates back to the late nineteenth century. The first commercial oilfield was struck at Digboi in North-Eastern India in the year 1890. Till the 1970s, petroleum production was mainly from oilfields in the North-Eastern region and Gujarat.

The government owned companies known as Public Sector Units (PSU) earlier dominated the upstream oil and gas industry. The two companies - Oil and Natural Gas Corporation Ltd (ONGC) and Oil India Ltd (OIL) were the main players. They were responsible for exploration and production. Bombay High (now known as Mumbai High) was discovered in the 1970s and was one of the largest finds in the world at that point of time (but not enough for a large country like India). The government felt the need for liberalizing participation of foreign companies for exploration and production.

In 1991, various offshore blocks were offered for licensing. The government policy now allows joint as well as private sectors to participate in this sector. The government has leased a number of blocks of potential fields to both Indian and multinational companies.

As a result of these measures the number of players in the upstream industry has gone up substantially. Reliance Petroleum became owner of a few major oilfields in the Mumbai High

region. A number of Indian and overseas private operators explored and produced oil from newly developed fields in Krishna Godavari and Kaveri basin. ONGC is still the biggest player upstream due to historical reasons. The proven oil and gas resources are still meager for India's size and requirement.

1.2.2. The Indian Perspective – Downstream

The refinery industry also dates back to over one hundred years. India's first refinery was built at Digboi in 1901 by British Petroleum. In the late '50s and early '60s multinational oil companies such as Shell, Caltex and Esso invested in refineries in India. Indian Refineries Ltd., the first state owned (public sector) refinery was built in Guwahati in the early sixties. Later it became Indian Oil Corporation.

India nationalized the refining and product marketing sector in 1976. Regulatory regime was introduced on production, distribution and pricing of crude oil and petroleum products. State owned companies such as Indian Oil Corporation, Bharat Petroleum and Hindustan Petroleum were the largest companies in the refinery sector.

The Administered Pricing Mechanism implemented in the seventies subsidized prices for products like kerosene and LPG. Charging higher prices for other products like gasoline and aviation fuel generated part of the subsidy. Diesel prices were kept neutral. The Administered Pricing Mechanism was based on fixed 12% post-tax return on net worth deployed for refining, distribution and marketing.

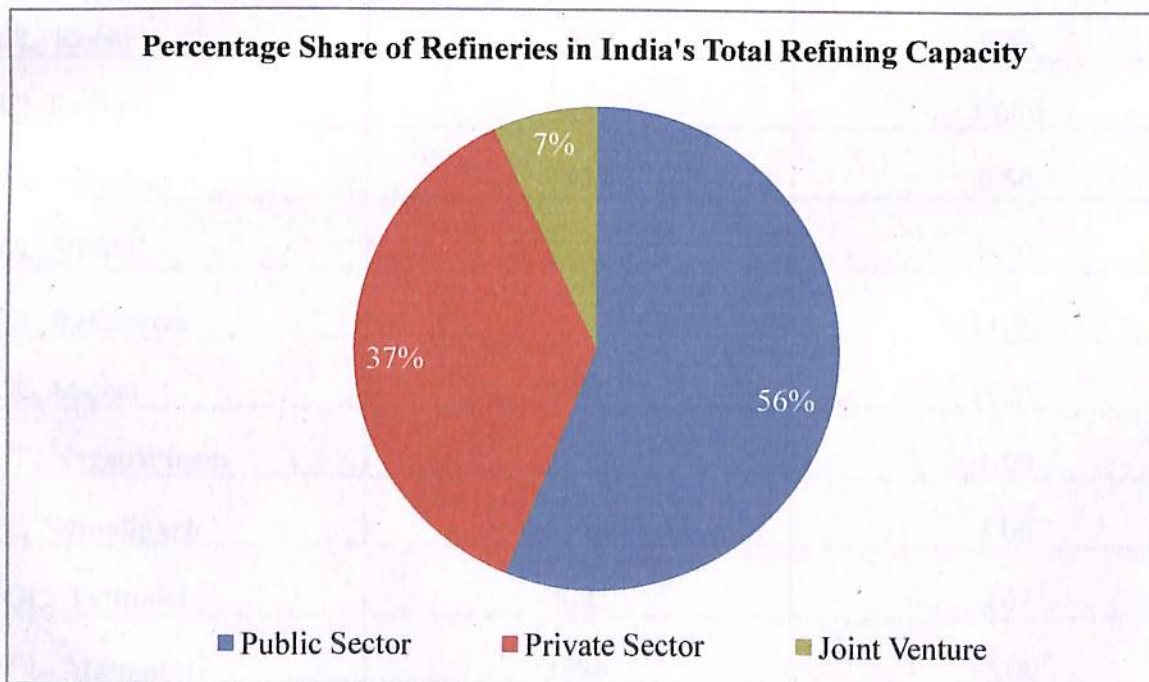


Figure 7 – Percentage Share of Refineries in India's Total Refining Capacity

Table 1 – Indian Refineries

Refinery	Year of Commissioning	Installed Capacity(MMTPA) as on 1.4.2013
IOCL Refineries		54.20
IOC, Digboi	1901	0.65
IOC, Guwahati	1962	1.00
IOC, Barauni	1964	6.00
IOC, Koyali	1965	13.70
IOC, Haldia	1974	7.50
IOC, Mathura	1982	8.00
IOC, Panipat	1998	15.00
IOC, Bongaigaon	1979	2.35
BPCL Refineries		21.50
BPCL, Mumbai	1955	12.00
BPCL, Kochi	1966	9.50
HPCL Refineries		14.80
HPCL, Mumbai	1954	6.50
HPCL, Visakh	1957	8.30
CPCL Refineries		11.50
CPCL, Manali	1969	10.50
CPCL, Nagapattinam	1993	1.00
NRL, Numaligarh	1999	3.00
ONGC, Tatipaka	2002	0.07
MRPL, Mangalore	1996	15.00
RPL Refineries		60.00

African Crude Potential in India

RIL, Jamnagar	1999	33.00
RIL(SEZ), Jamnagar	2008	27.00
Essar Oil Ltd., Vadinar	2006	20.00
BPCL- BORL, Bina	2011	6.00
HMEL, Bhatinda	2012	9.00
Total		215.07

1.3. Africa: An Introduction



Figure 8 Africa

Africa is the world's second-largest and second-most-populous continent. At about 30.2 million km² (11.7 million sq mi) including adjacent islands, it covers six percent of the Earth's total surface area and 20.4 percent of the total land area. With 1.0 billion people (as of 2009, see table), it accounts for about 15% of the world's human population. The continent is surrounded by the Mediterranean Sea to the north, both the Suez Canal and the Red Sea along the Sinai

Peninsula to the northeast, the Indian Ocean to the southeast, and the Atlantic Ocean to the west. The continent includes Madagascar and various archipelagoes. It has 54 fully recognized sovereign states ("countries"), 9 territories and two de facto independent states with limited or no recognition.

Africa, particularly central Eastern Africa, is widely accepted as the origin of humans and the Hominidae clade (great apes), as evidenced by the discovery of the earliest hominids and their ancestors, as well as later ones that have been dated to around seven million years ago – including Sahelanthropus tchadensis, Australopithecus africanus, A. afarensis, Homo erectus, H. habilis and H. ergaster—with the earliest Homo sapiens (modern human) found in Ethiopia being dated to circa 200,000 years ago. Africa straddles the equator and encompasses numerous climate areas; it is the only continent to stretch from the northern temperate to southern temperate zones.

1.3.1. Political Scenario

The African Union (AU) is a 54 member federation consisting of all of Africa's states except Morocco. The union was formed, with Addis Ababa, Ethiopia, as its headquarters, on 26 June 2001. The union was officially established on 9 July 2002 as a successor to the Organisation of African Unity (OAU). In July 2004, the African Union's Pan-African Parliament (PAP) was relocated to Midrand, in South Africa, but the African Commission on Human and Peoples' Rights remained in Addis Ababa. There is a policy in effect to decentralize the African Federation's institutions so that they are shared by all the states.

The African Union, not to be confused with the AU Commission, is formed by the Constitutive Act of the African Union, which aims to transform the African Economic Community, a federated commonwealth, into a state under established international conventions. The African Union has a parliamentary government, known as the African Union Government, consisting of legislative, judicial and executive organs. It is led by the African Union President and Head of State, who is also the President of the Pan-African Parliament. A person becomes AU President by being elected to the PAP, and subsequently gaining majority support in the PAP. The powers and authority of the President of the African Parliament derive from the Constitutive Act and the Protocol of the Pan-African Parliament, as well as the inheritance of presidential authority stipulated by African treaties and by international treaties, including those subordinating the Secretary General of the OAU Secretariat (AU Commission) to the PAP. The government of the AU consists of all-union (federal), regional, state, and municipal authorities, as well as hundreds of institutions, that together manage the day-to-day affairs of the institution.

Political associations such as the African Union offer hope for greater co-operation and peace between the continent's many countries. Extensive human rights abuses still occur in several parts of Africa, often under the oversight of the state. Most of such violations occur for political reasons, often as a side effect of civil war. Countries where major human rights violations have

been reported in recent times include the Democratic Republic of the Congo, Sierra Leone, Liberia, Sudan, Zimbabwe, and Côte d'Ivoire.

1.3.2 Economy

Although it has abundant natural resources, Africa remains the world's poorest and most underdeveloped continent, the result of a variety of causes that may include the spread of deadly diseases (notably HIV/AIDS and malaria), corrupt governments that have often committed serious human rights violations, failed central planning, high levels of illiteracy, lack of access to foreign capital, and frequent tribal and military conflict (ranging from guerrilla warfare to genocide). According to the United Nations' Human Development Report in 2003, the bottom 25 ranked nations (151st to 175th) were all African.

Poverty, illiteracy, malnutrition and inadequate water supply and sanitation, as well as poor health, affect a large proportion of the people who reside in the African continent. In August 2008, the World Bank announced revised global poverty estimates based on a new international poverty line of \$1.25 per day (versus the previous measure of \$1.00). 80.5% of the Sub-Saharan Africa population was living on less than \$2.50 (PPP) a day in 2005, compared with 85.7% for India.

The new figures confirm that sub-Saharan Africa has been the least successful region of the world in reducing poverty (\$1.25 per day); some 50% of the population living in poverty in 1981 (200 million people), a figure that rose to 58% in 1996 before dropping to 50% in 2005 (380 million people). The average poor person in sub-Saharan Africa is estimated to live on only 70 cents per day, and was poorer in 2003 than he or she was in 1973 indicating increasing poverty in some areas. Some of it is attributed to unsuccessful economic liberalization programs spearheaded by foreign companies and governments, but other studies and reports have cited bad domestic government policies more than external factors.

From 1995 to 2005, Africa's rate of economic growth increased, averaging 5% in 2005. Some countries experienced still higher growth rates, notably Angola, Sudan and Equatorial Guinea, all three of which had recently begun extracting their petroleum reserves or had expanded their oil extraction capacity. The continent is believed to hold 90% of the world's cobalt, 90% of its platinum, 50% of its gold, 98% of its chromium, 70% of its tantalite, 64% of its manganese and one-third of its uranium. The Democratic Republic of the Congo (DRC) has 70% of the world's coltan, and most mobile phones in the world are made with elements refined from this mineral. The DRC also has more than 30% of the world's diamond reserves. Guinea is the world's largest exporter of bauxite. As the growth in Africa has been driven mainly by services and not manufacturing or agriculture, it has been growth without jobs and without reduction in poverty levels. In fact, the food security crisis of 2008 which took place on the heels of the global financial crisis has pushed back 100 million people into food insecurity.

In recent years, the People's Republic of China has built increasingly stronger ties with African nations. In 2007, Chinese companies invested a total of US\$1 billion in Africa.

1.2.3. Oil Reserves

As of January 2011, Africa held proven oil reserves of approximately 132.1 billion barrels, representing approximately 9.5 per cent of the total world oil reserves. Africa's contribution to world reserves has increased significantly from ~7.0 per cent in 1995 to approximately 9.5 per cent in 2010, fuelled primarily by the growing reserves in Libya, Nigeria and Angola. This trend is likely to continue in view of newer discoveries announced in Ghana, Egypt, Algeria, Libya, Tunisia, Mozambique, and Uganda in 2010.

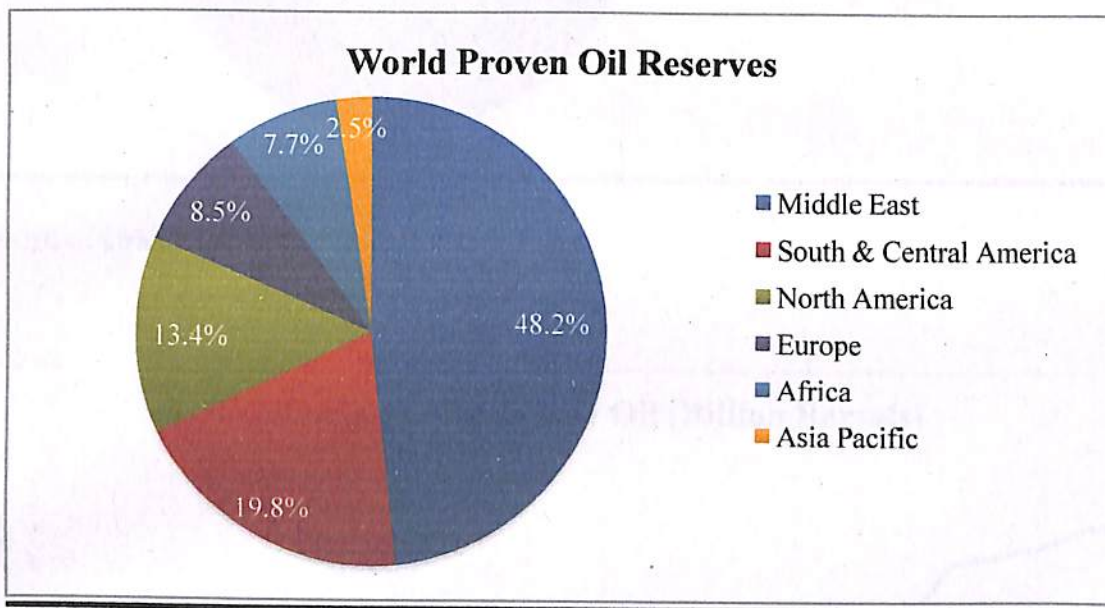


Figure 9 – World Proven Oil Reserves

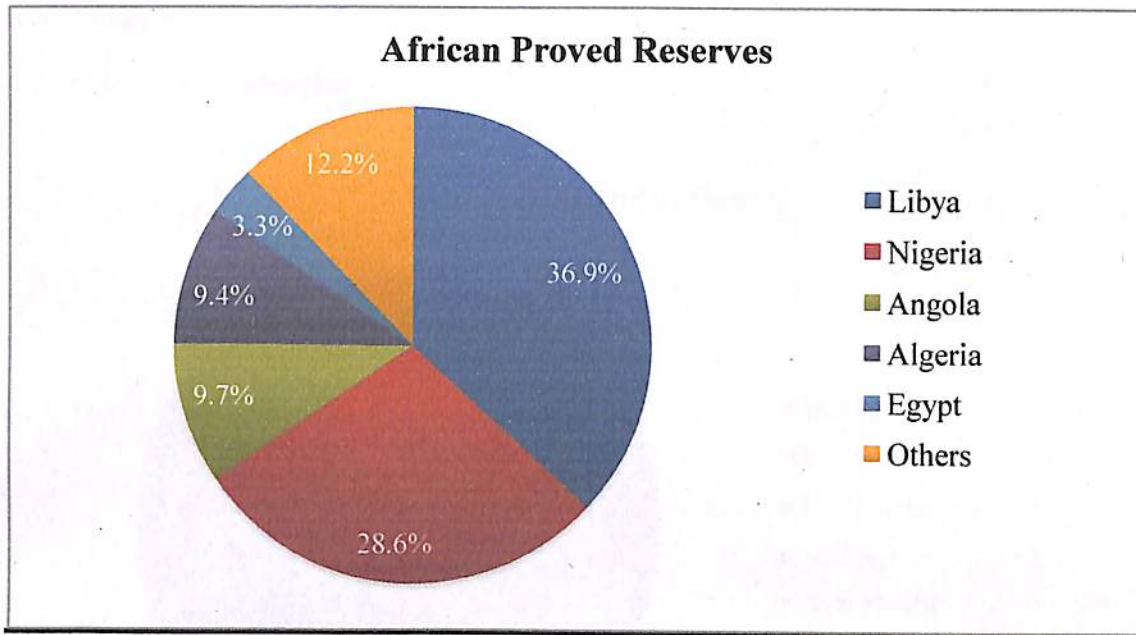


Figure 10 – African Proved Reserves

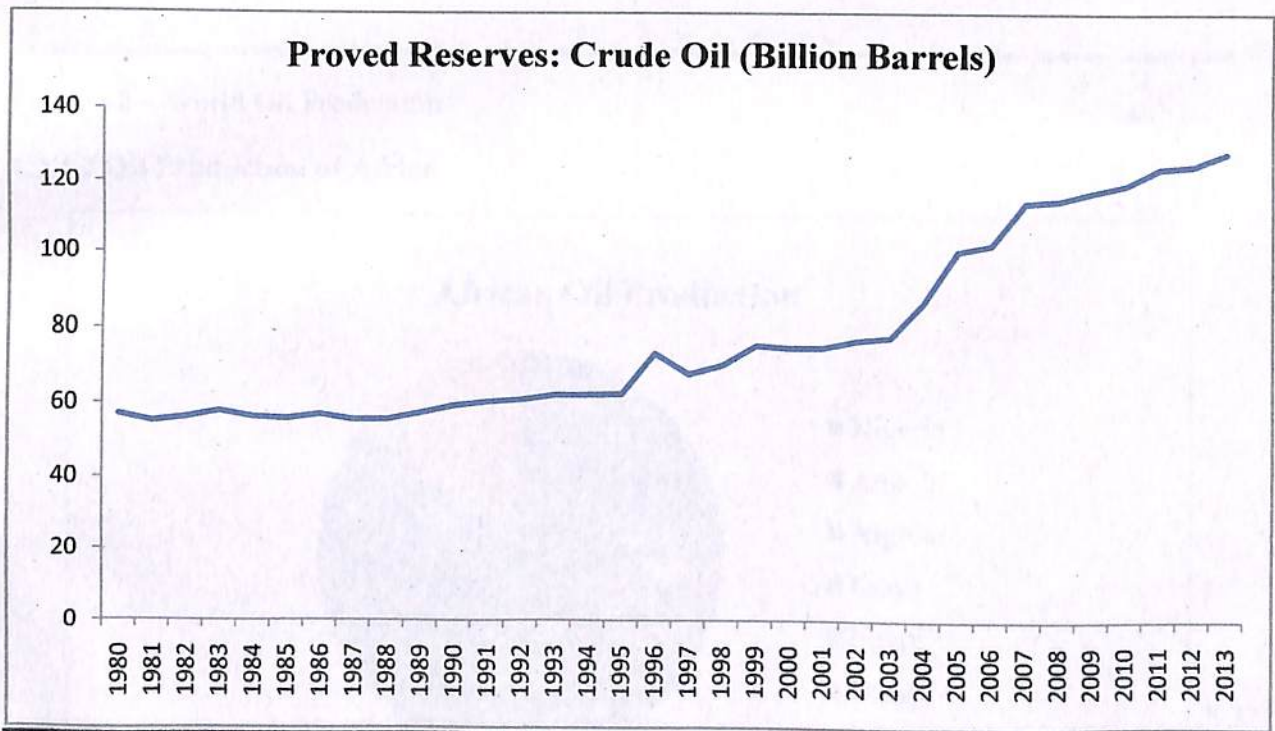


Figure 11 - Proved Reserves of Oil Trend, Africa

1.3.4. Oil Supply

1.3.4.1 World Oil Production

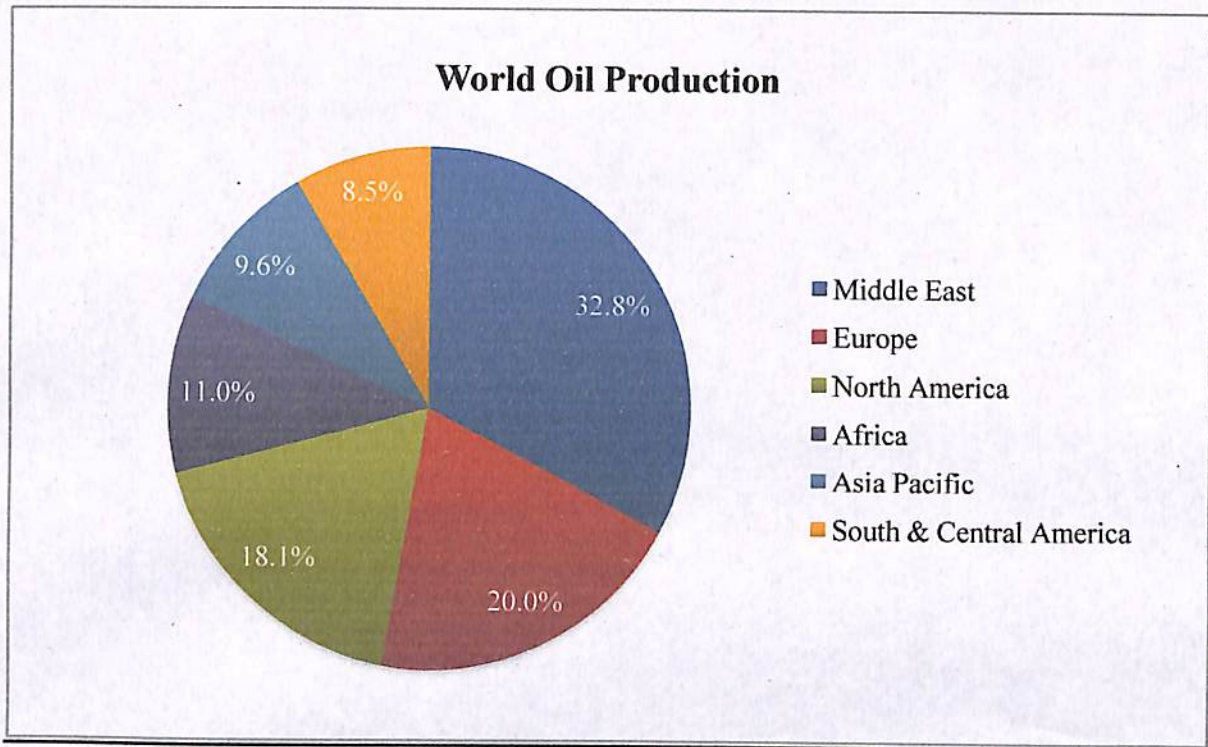


Figure 12 – World Oil Production

1.3.4.2 Oil Production of Africa

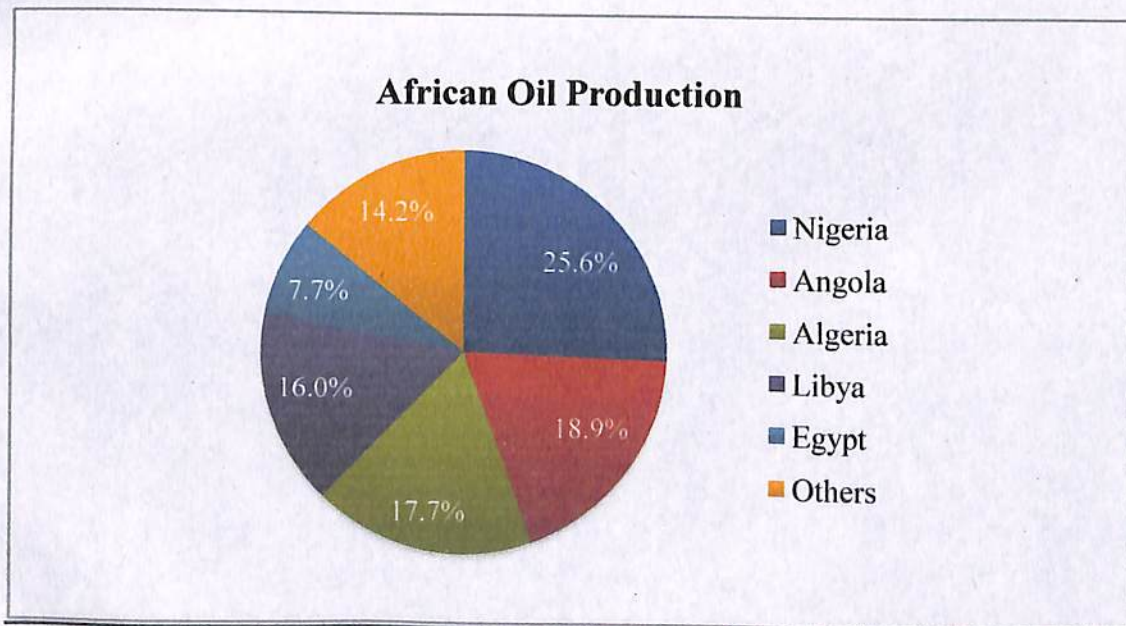


Figure 13 – African Oil Production

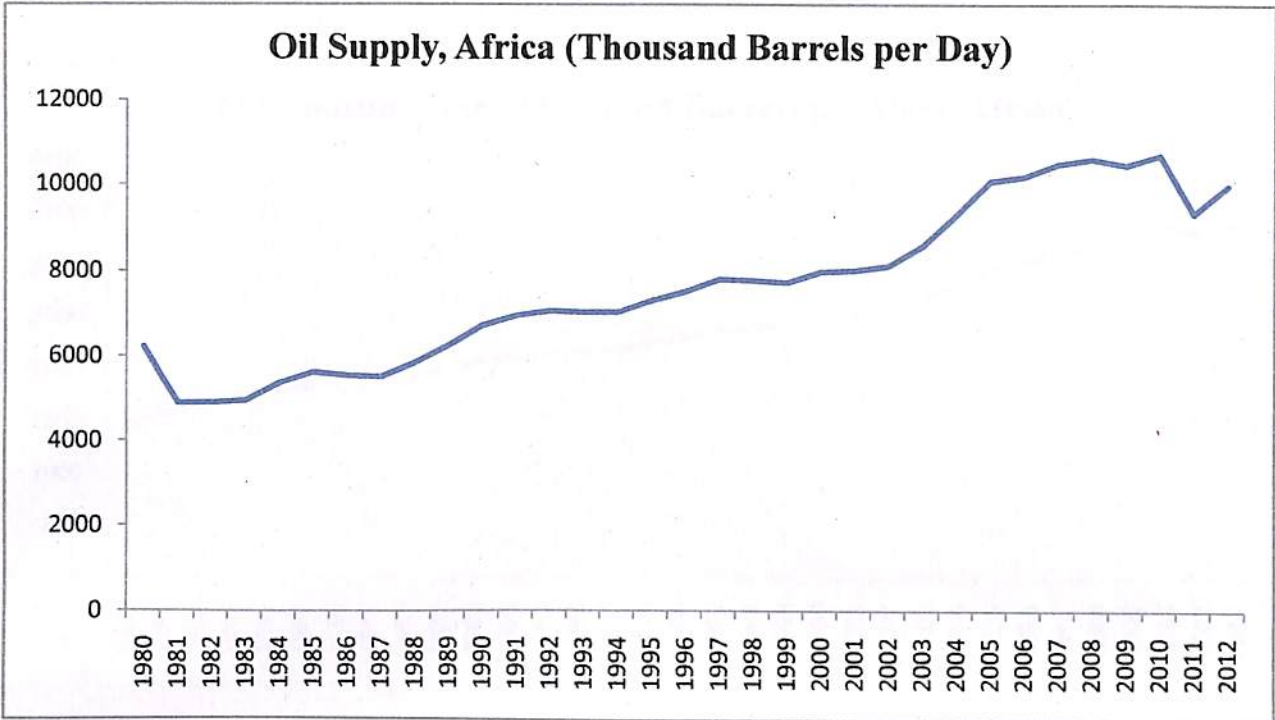


Figure 14 – Oil Supply of Africa

1.2.3.1.Oil Consumption

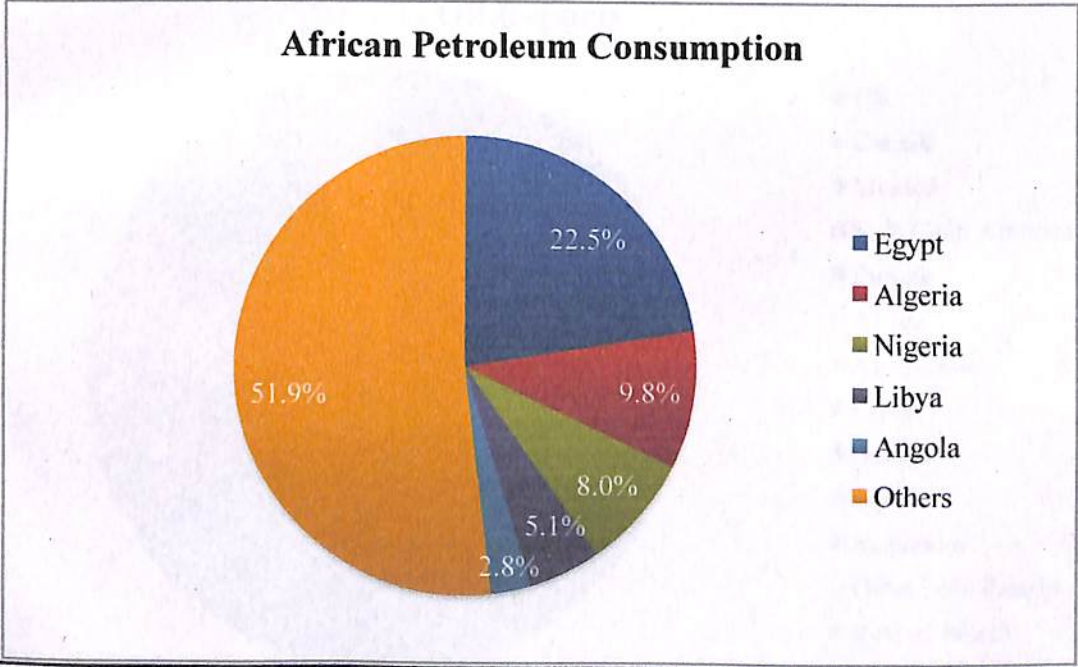


Figure 17 – African Petroleum Consumption

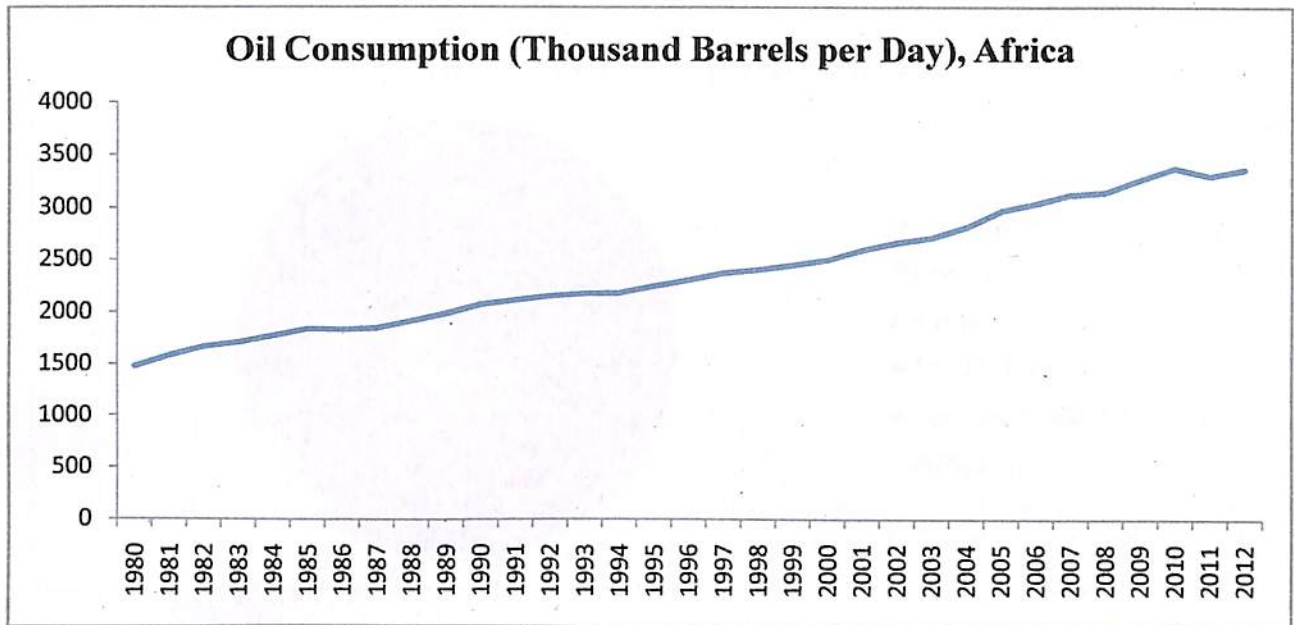


Figure 16 – Oil Consumption Trend, Africa

1.3.4.3. African Oil Exports

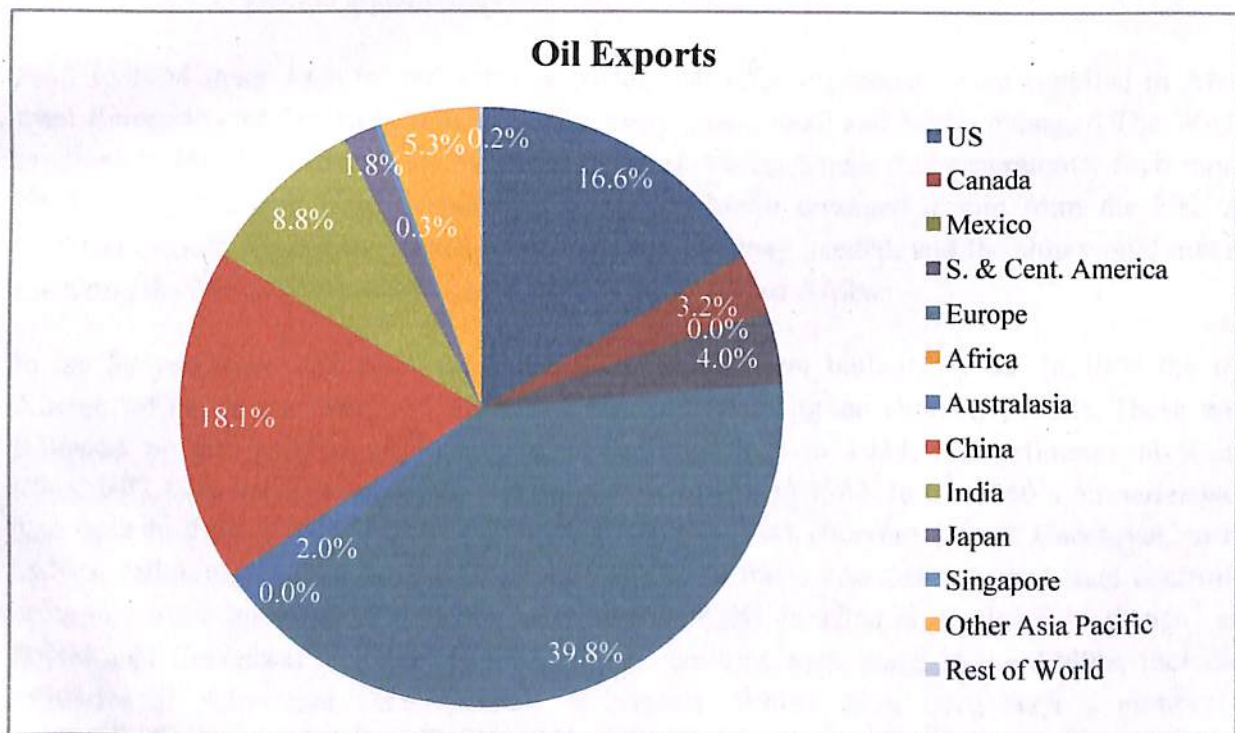


Figure 17 – African Oil Exports

1.3.3 Refining Capacity of Africa

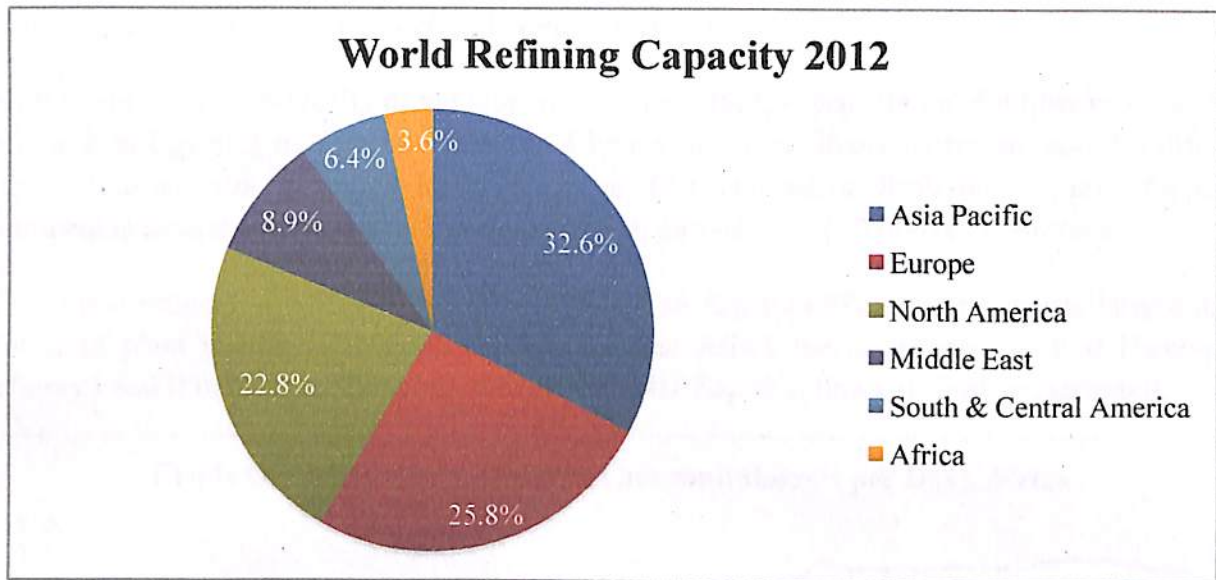


Figure 18 – World Refining Capacity 2012

According to the 2013 BP Statistical Energy Survey, Africa had a 2011 refinery capacity of 3317 thousand barrels a day, 3.56% of the world total. Refinery throughput was 2219 thousand barrels a day, 2.93% of the world total. Oil refineries convert crude oil into fuel products, lubricating oils, bitumen and chemical feedstocks.

Prior to 1954 there were no refineries in Africa. All refined products were supplied to Africa from European and American refineries. For many years, Shell and Mobil managed The WARP programme for all the marketers operating in West Africa. Under this programme, each month Shell arranged a ship from Curacao refinery, and Mobil arranged a ship from the UK. All marketers would request the quantities of each product they needed, and the ship would make a run along the coast. There was a similar arrangement in East Africa.

In the 50 years between 1954 and 2004 48 refineries were built in Africa. In 1954 the first African refineries were built in Algiers (CFP/Total) and Durban (Socony/Mobil). These were followed by the building of Luanda refinery (Petrofina) in 1958, and refineries in Kenya (Shell/BP), Ghana (ENI/Agip), and Senegal (consortium), in 1963. In the 1960's refineries were also built in Cote d'Ivoire, Gabon, Tanzania, Nigeria (Port Harcourt I), and Capetown. In the 1970's, following nationalisation of the oil industry in many countries, several state controlled refineries were built, such as Arzew in Algeria, Warri in Nigeria, CORAF in Congo, and SoNaRa in Cameroon. A final burst of refinery building took place in the 1980's, including refineries at Warri and Port Harcourt in Nigeria. Whilst there have been a number of modernisation projects since then, the only new refineries built in the past 10 years have been Khartoum in 2001, and MIDOR in Egypt in 2002.

Even whilst refineries were being built, others were already being closed. In 1966 the Zimbabwe refinery closed due to sanctions imposed during the UDI period. Between 1980 and 2003 a further 10 uneconomic refineries closed permanently.

All the refineries are basically of the topping/reforming type, except for the 4 refineries in South Africa, 2 in Egypt, 3 in Nigeria, 1 in Cote d'Ivoire, and 1 in Ghana, There are also 3 Synfuel plants (coal and gas feedstock) in South Africa. The total active distillation capacity for the continent is around 3 million b/d (15 million mt/yr), an average of 79,000 b/d per refinery.

The largest refinery in Africa is the Skikda refinery in Algeria (300mbd), the second largest the RasLanuf plant in Libya (220mbd). In Sub Saharan Africa the largest are the Port Harcourt refinery I and II in Nigeria (210mbd), and the Shell/BP Sapref refinery in Durban (165mbd).

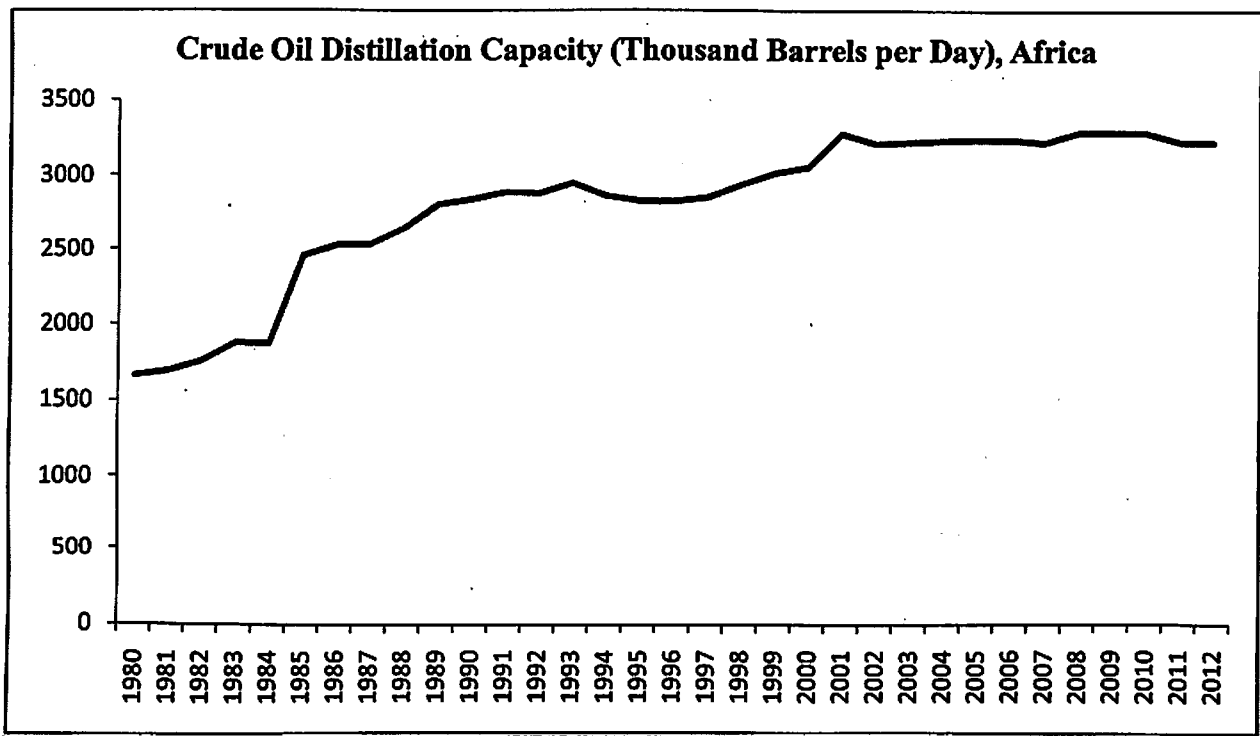


Figure 19 – Crude Distillation Capacity, Africa

Excluding some specialty plants (remote locations, bitumen) the smallest operating refinery is the 14mbd Solimar refinery in Madagascar, which operates only occasionally. There are several small 20mbd refineries including Sogara Gabon, Indeni Zambia, SAR Senegal and CORAF Congo.

The major refining centres in Africa are in South Africa, Nigeria, Egypt and Algeria.

South Africa has 4 refineries and 3 synfuels plants.

- Caltex has a 5.5 million mt/yr (110,000 b/d) refinery in Cape Town.
- Shell and BP have joint ownership of the 8.2 million mt per annum (165,000 b/d) Sapref refinery in Durban.
- Engen has the 6 million mt/yr (125,000 b/d) Enref refinery in Durban.
- Sasol and Total have joint ownership of the 4.2 million mt/yr (85,000 b/d) Natref refinery in Sasolburg.

All the South African refineries have undergone major expansions and upgrading since 1990.

Nigeria has four refineries, all owned by the Nigerian National Petroleum Company, NNPC. The Nigerian government has announced its intention to sell 51% of each of the refineries in 2004.

- Kaduna refinery in northern Nigeria was built in 1980 with a capacity of 5.5 million mt/yr (110,000 b/d). A Lube Baseoil plant was added in 1982, and an LAB plant in 1987.
- Warri refinery in the south central region was built in 1978 with a capacity of 6.2 million mt/yr (125,000 b/d). A Carbon Black plant and a Polypropylene plant were added in 1986.
- Port Harcourt refinery in the southeast is made up of two refineries, built in 1965 and 1989. In 1993 they were merged into one, with a total capacity of 10.500 million mt/yr (210,000 b/d). The Eleme Petrochemical plant, which was built adjacent to the Port Harcourt refinery in 1995, has an Olefin production capacity of 483,000 mt/yr, a Polypropylene capacity of 80,000 mt/yr and a Polyethylene production capacity of 250,000 mt/yr.

The Nigerian oil industry has been impacted seriously by operational problems during recent years, and production has been below 50% of capacity.

Egypt has 9 refineries mostly concentrated in the northeast (Cairo, Alexandria, Suez). Egyptian General Petroleum Corp (EGPC) operates all but one of the refineries. The exception is the MIDOR Refinery in Alexandria.

- El Mex refinery in Alexandria is operated by the Alexandria Petroleum Company. It has a capacity of 100,000 b/d, and 22,500 b/d of vacuum distillation capacity. In addition it has a Lube Baseoil manufacturing plant and a Bitumen unit.
- Cairo Petroleum Refining Company in Mostorod, near Cairo. This refinery has a capacity of 145,000b/d.
- The El-Nasr Petroleum Company near Suez has a capacity of 99,300 b/d. It has a 35,000

b/d Hydrocracker and a Bitumen unit.

- The Amiriyah Petroleum Refining Company in Alexandria has a capacity of 78,000 b/d, and a 15,000 b/d vacuum distillation unit. It has a 9,000 b/d Alkylation unit, and a 2,000 b/d lube baseoil manufacturing unit.
- The Suez Petroleum Processing Company near Suez has a capacity of 66,400 b/d, and a 9,500 b/d vacuum distillation unit. It has a 16,400 b/d Delayed Coker, and a 1,000 b/d Lube Baseoil unit.
- The Asyut Petroleum Refining Company near the center of Egypt has a capacity of 47,000 b/d. This simple refinery has a small Naphtha Reformer, and is designed to supply product to the central and southern regions.
- The Tanta refinery near Port Said is operated by the Cairo Petroleum Refining Company. It has a capacity of 35,000 b/d. Other than a small Hydrotreating unit it has no upgrading capacity.
- The El-Nasr Petroleum Company operates the small WadiFeran refinery on the Red Sea in the Gulf of Suez. It has capacity of 7,000 b/d, and was designed to service operations related to the Suez Canal.
- The Middle East Oil Refinery (MIDOR) was completed in 2002 in the Amiriyah Free Zone, Alexandria. It has a capacity of 100,000 b/d, and has a 35,000 b/d Hydrocracker, a 22,800 b/d Coker, and a 10,700 b/d Isomerisation unit. This is the only privately owned refinery in Egypt. It was originally a joint Egyptian/Israeli venture, but the Israeli shareholders sold out to the Egyptian National Bank in 2001.

Algeria is another major refining centre with 4 refineries.

- Algiers refinery, built in 1964, has a capacity of 60,000 b/d. It was built by CFP/Total to supply the main market. It has no cracking capacity, and no special units.
- Arzew refinery, built in 1973, has a capacity of 60,000 b/d. It was built by Sonatrach as an export refinery. It has no cracking facilities, but has Lube Baseoil (1984 built), and Bitumen units.
- Skikda refinery, built in 1980 (expanded in 1993), has a capacity of 300,000 b/d. It was built by Sonatrach as an export refinery and petrochemical complex. It has no cracking facilities, but has an Aromatics unit (BTX) and a Bitumen plant.
- HassiMessaoud, a small refinery in southern Algeria, built in 1960, and expanded in 1979, has a capacity of 30,000 b/d.

The 6,000 b/d refinery in In Amenas was shutdown in 1986.

Many African refineries have been forced to close a result of low worldwide refining margins, small local markets, high operating cost (due to small size), and poor yields. Following the

World Bank/IMF insistence on market liberalisation in the early 1980's, many of the remaining refineries have faced significant challenges.

1.3.4. Highest crude oil producing countries in Africa 2012

#1. Nigeria

Barrels per day: 2,417,000

Nigeria is the largest oil producer in Africa and produces 116.2 MT of oil. Oil production in Nigeria is surrounded by much controversy. Recently, \$100 million fine was imposed on Royal Dutch Shell by a Nigerian court for a 1970 oil spill. Also, the militant attacks pose a major threat to the Nigerian oil and gas operations. Recently, in two separate events, 150 people lost their lives in a militant attack in Nigeria. One of the attack was in an oil field.

#2. Angola

Barrels per day: 1,784,000

Angola produces 86.9MT of oil. In 2010, the CEO and the top managers of the state owned oil firm Sonatrach were fired due to a corruption scandal. Recently, many joint ventures made way in the Angolan oil industry.

#3. Algeria

Barrels per day: 1,667,000

Algeria produces 73 million tonnes of oil and is the third largest producer in Africa of oil. Algeria has built reserves upto \$200 billion from oil and gas exports. The country remained stable even at the times of civil unrest of 2011 in the neighboring African countries.

#4. Libya

Barrels per day: 1,509,000

Libya produces 71.1 MT of oil. The prices of oil skyrocketed at the time of civil unrest in Libya.

#5. Egypt

Barrels per day: 728,000

Egypt produces 35.4 MT of oil. Oil production was disrupted to some extent due to the unrest in the year 2011.

#6. Rest of Africa

Barrels per day: 1,336,000

The rest of African countries produce around 66.4 MT of oil per day. Rest of Africa include countries like Republic of Congo (15.3 MT), Equatorial Guinea (13.2 MT), Gabon (12.3 MT), Chad (5.3 MT) and other African countries.

1.4. Country Profiles

1.4.1 Nigeria

Capital: Abuja

Population: 177,155,754 (July 2014 est.)

Currency: Nigerian Naira

GDP Real: 6.2% (2013 est.)

Government Type: Federal Republic

Nigeria, an OPEC member since 1971, is the largest oil producer in Africa and the eleventh largest oil producer in the world.

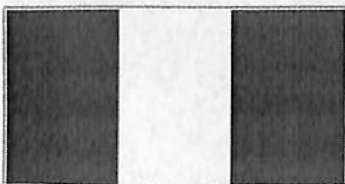
1.4.1.1. Introduction

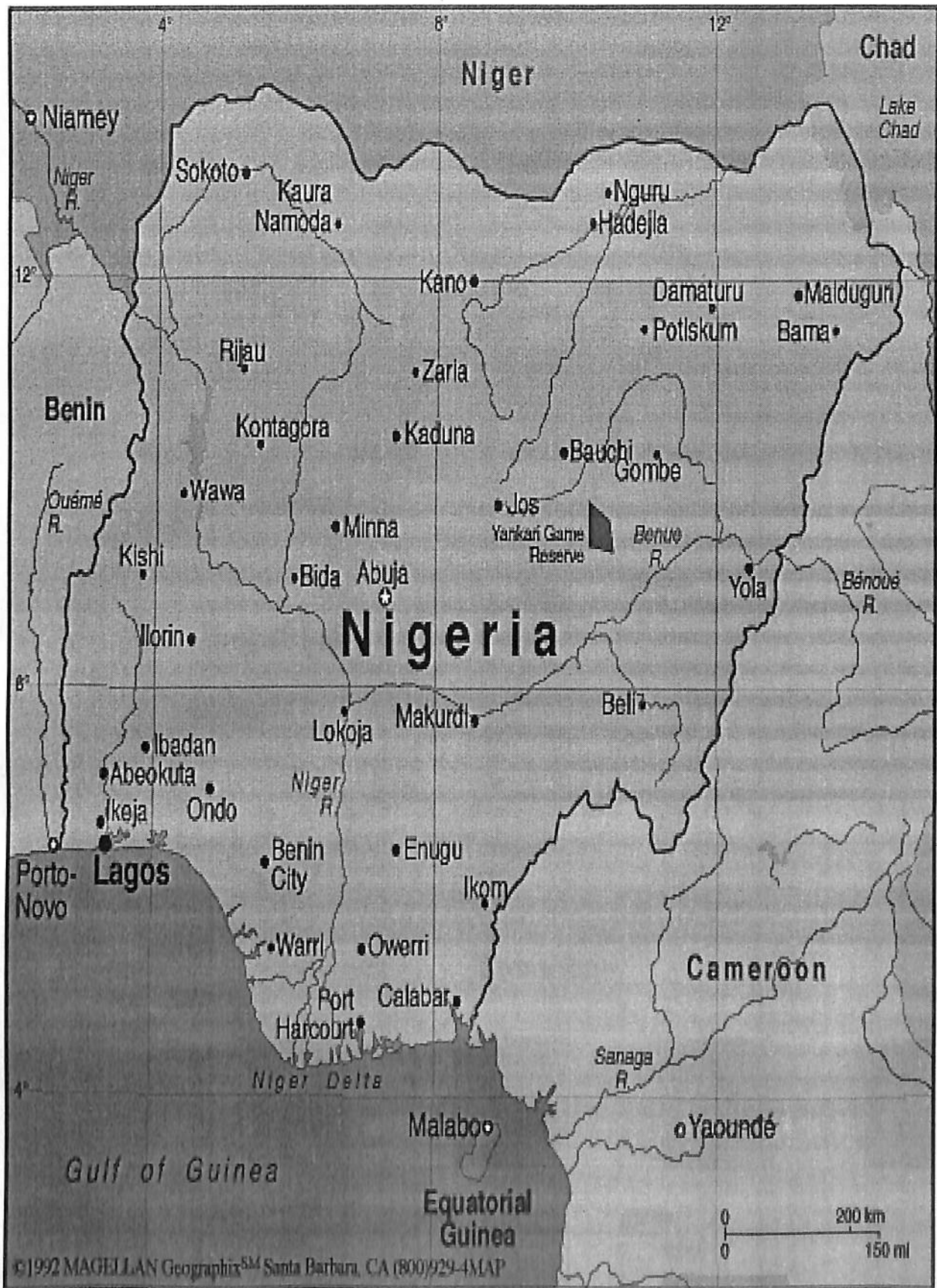
British influence and control over this country of Africa grew through the 19th century. Nigeria gained its independence from United Kingdom in the year 1960. The constitution was adopted after military rule in the year 1999. The government continues to face the difficult task of reforming a petroleum-based economy, whose revenues have been squandered through corruption and mismanagement, and institutionalizing democracy. In addition, Nigeria continues to experience longstanding ethnic and religious tensions. Although both the 2003 and 2007 presidential elections were marred by significant irregularities and violence, Nigeria is currently experiencing its longest period of civilian rule since independence. The general elections of April 2007 marked the first civilian-to-civilian transfer of power in the country's history. In January 2014, Nigeria assumed a nonpermanent seat on the UN Security Council for the 2014-15 term.

Geography

The total area of Nigeria is around 923,768 sq km comprising of 910,768 sq km of land and 13,000 sq km of water. Nigeria shares its borders with Benin, Cameroon, Chad, and Niger.

National Flag





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1.4.1.2 Nigeria Crude Oil Production⁴

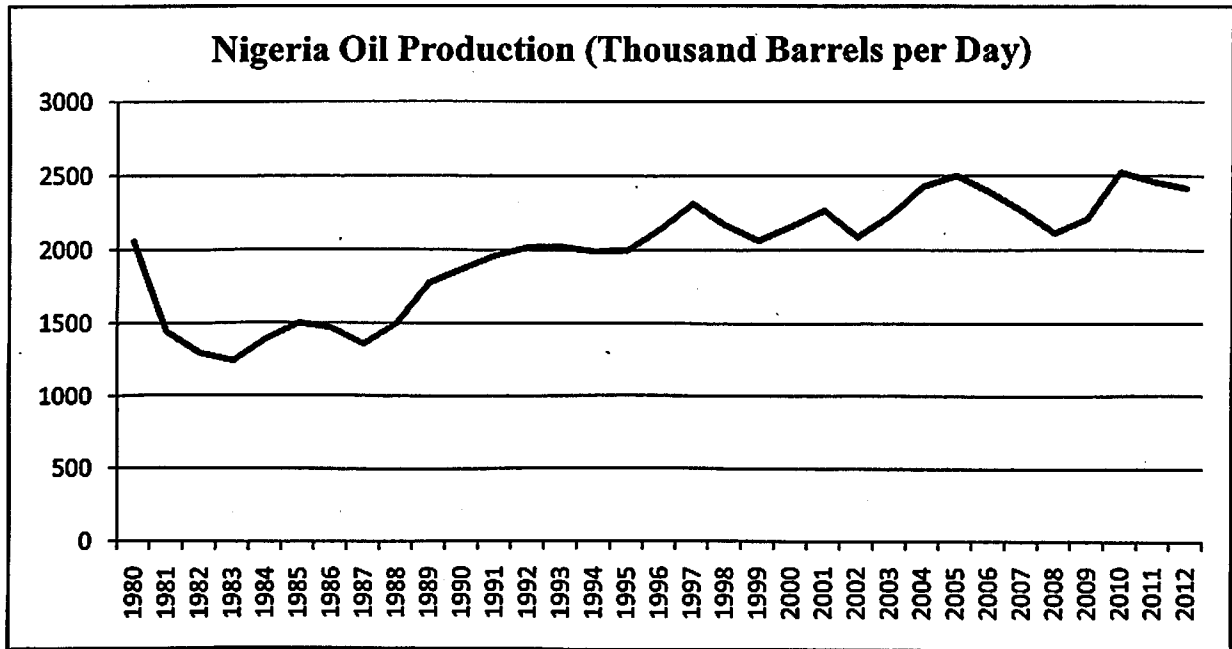


Figure 20 – Nigeria Oil Production

1.4.1.3 Nigeria Crude Oil Consumption⁵

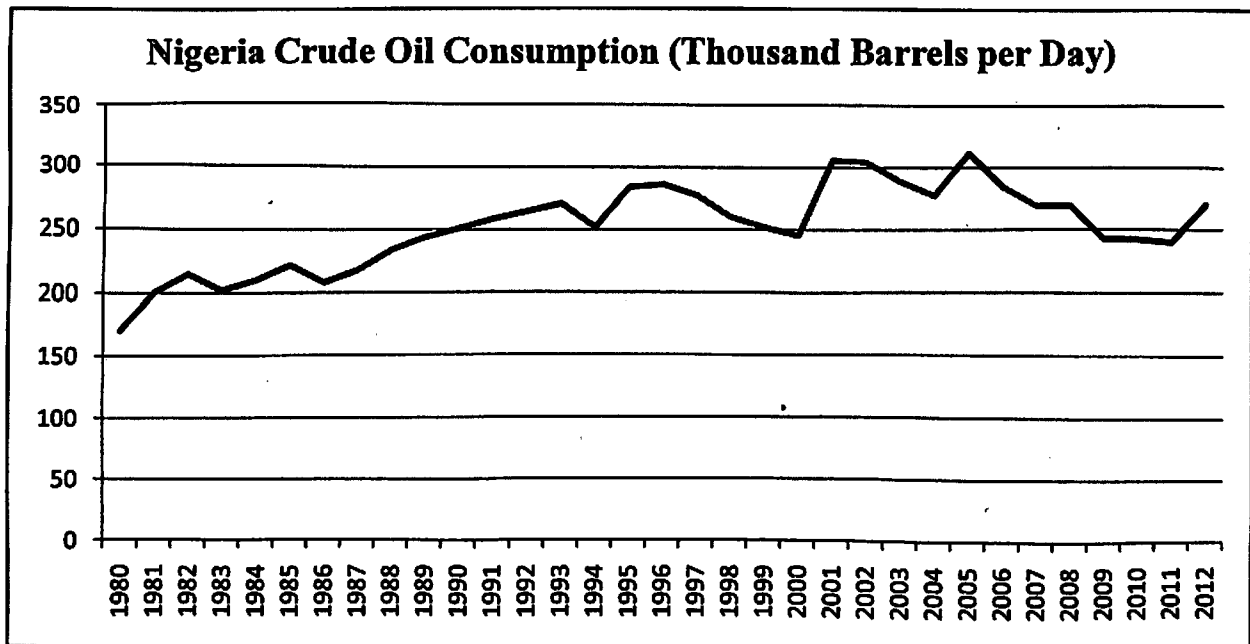


Figure 21 – Nigeria Oil Consumption

⁴ Source: BP Statistical Review of World Energy

⁵ Source: EIA

1.4.1.4 Nigeria Oil Market Overview

The petroleum industry is the largest and main generator of gross domestic product in Nigeria. For over five decades, Nigeria continues to experience remarkable increases in operational activities in her oil and gas exploration and exploitation, refining and products marketing. Crude oil was discovered in commercial quantity in the Niger Delta region of Nigeria in 1956. Since then, oil exploration and exploitation has continued resulting into environmental destruction due to neglect and limited concern by the multinational companies in environmental management in the area.

The operations of Nigeria's oil industry are in three major areas, namely, crude oil exploration and exploitation, refining and products transportation and marketing.

Since 1956 when the first oil well was drilled, over 1,481 oil wells have sprung up, producing from about 159 oil fields. There are more than 7,000 kilometers of pipelines and flow lines and 275 flow stations operated by more than 13 oil companies. Nigeria's crude oil production stood at about 2.68 million bpd as at February, 2012.

Nigeria has four refineries (Port Harcourt I and II, Warri, and Kaduna) with a combined capacity of about 450,000 bpd. The refineries came under the management and ownership by Nigerian National Petroleum Corporation (NNPC) in January, 1986. All the refineries produce the normal range of products which include Liquefied Petroleum Gas, Premium Motor Spirit, Dual Purpose Kerosene, Aviation Turbine Kerosene and Automatic Gas Oil.

The Petroleum Products and Marketing Company (PPMC), a subsidiary of the NNPC, ensures that refined petroleum products are distributed nationwide from the refineries. They are transported through a national network of pipelines linking all the 21 petroleum products storage depots strategically located all over the country. The PPMC distribution network is made up of three separate systems for the supply of gasoline, kerosene and diesel and complemented by coastal barges and road haulage from the refineries and depots to marketers' outlets nationwide.

s/n	Year Commissioned	Capacity (barrels per day)				
		1965	1971	1978	1988	2010
1.	Port – Harcourt Refinery I	35,000	60,000	60,000	60,000	60,000
2.	Port – Harcourt Refinery II	-	-	-	150,000	150,000
3.	Warri Refinery	-	-	100,000	125,000	125,000
4.	Kaduna Refinery	-	-	100,000	110,000	110,000
	Total	35,000	60,000	260,000	445,000	445,000

Table 2 – Nigeria Refineries

1.4.1.5. Operating Risks Associated

- High rate of corruption and scams prevailing in the country
- Growing terrorist activities in the country

1.4.2. Algeria

Capital: Algiers

Population: 38,813,722 (July 2014 est.)

Currency: Algerian dinar (DZD)

Government Type: Democratic

GDP Real: 3.1% (2013 est.)

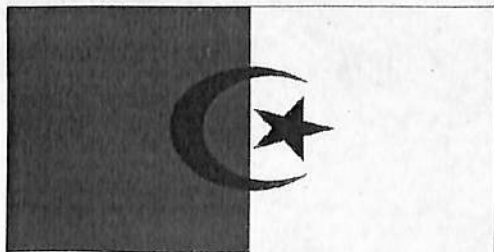
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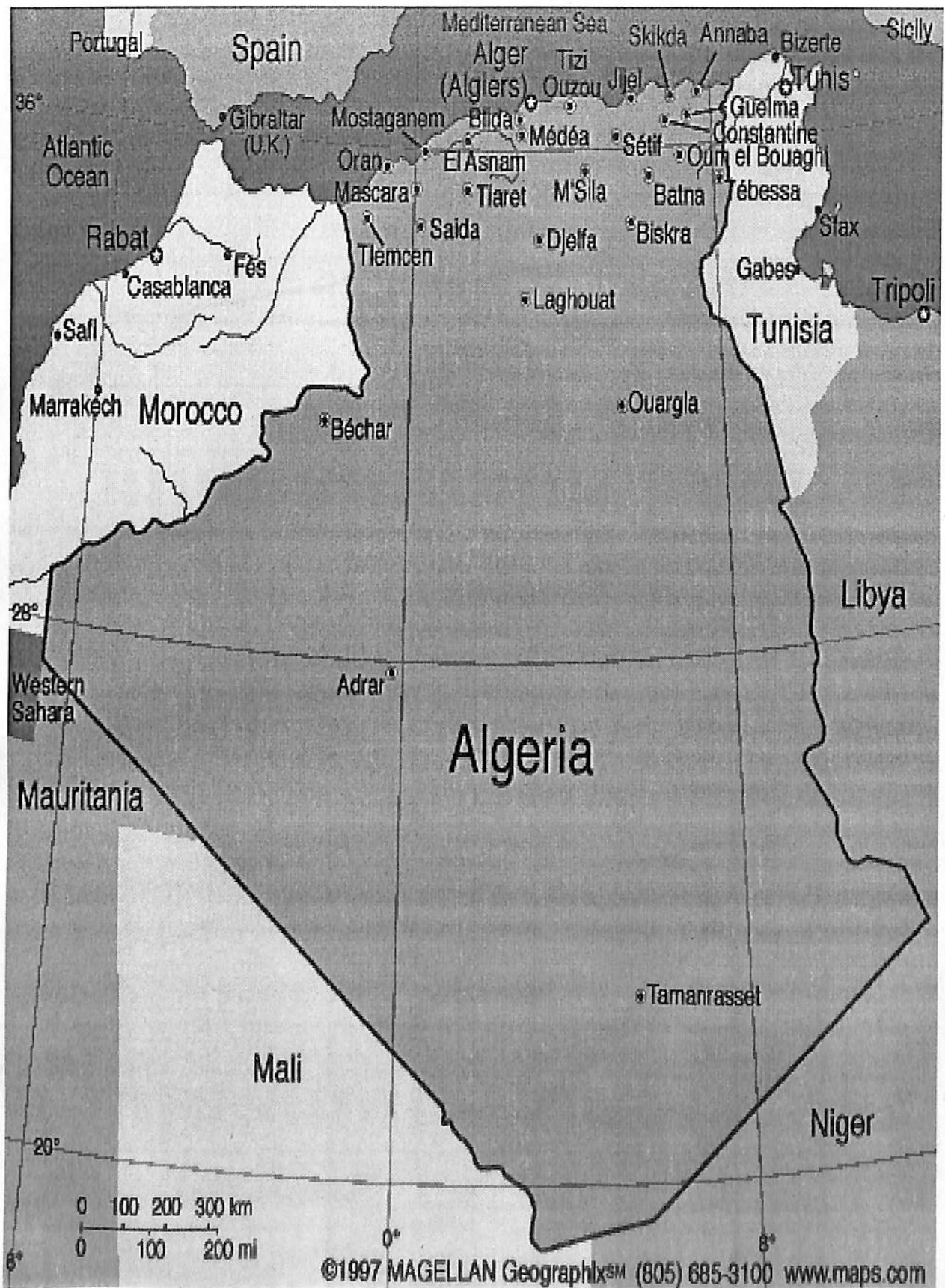
After more than a century of rule by France, Algerians fought through much of the 1950s to achieve independence in 1962. Longstanding problems continue to face BOUTEFLIKA, including large-scale unemployment, a shortage of housing, unreliable electrical and water supplies, government inefficiencies and corruption, and the continuing activities of extremist militants. Parliamentary elections in May 2012 and municipal and provincial elections in November 2012 saw continued dominance by the National Liberation Front (FLN). Political protest activity in the country remained low in 2013, but small, sometimes violent socioeconomic demonstrations by disparate groups continued to be a common occurrence. Parliament in 2014 is expected to revise the constitution.

Geography

The total area of Algeria is around 2,381,741 sq km. Algeria falls in the Northern Africa, bordering the Mediterranean Sea, between Morocco and Tunisia.

National Flag





1.4.2.1. Algeria Crude Oil Production⁶

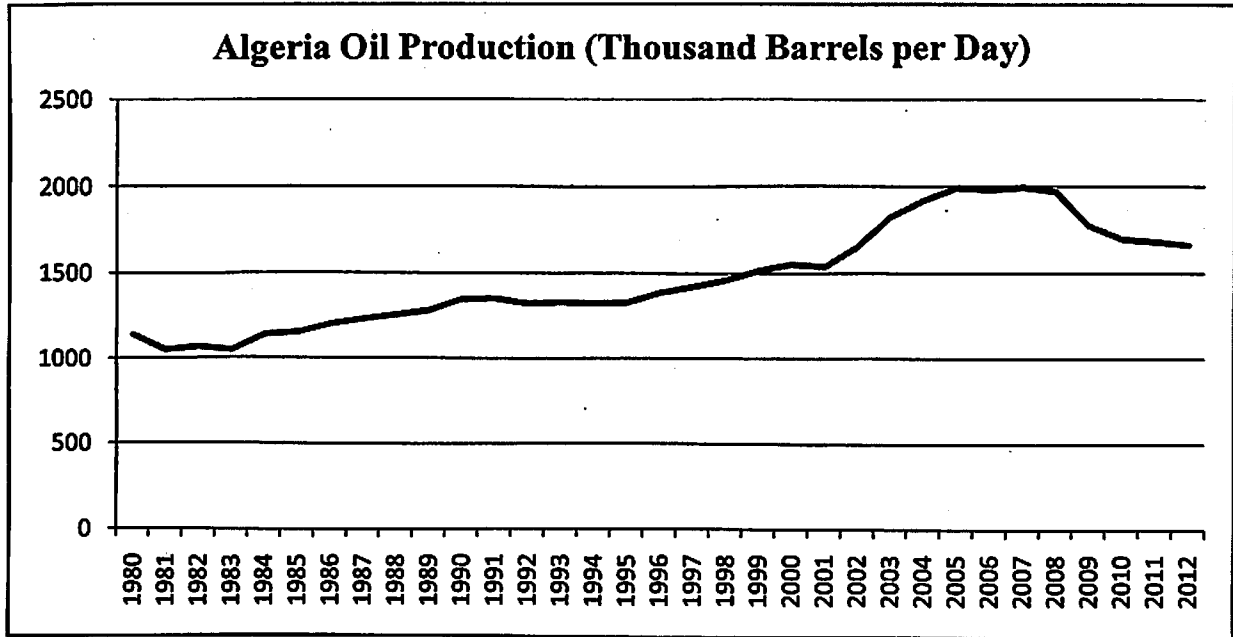


Figure 22 - Algeria Oil Production

1.4.2.2. Algeria Crude Oil Consumption⁷

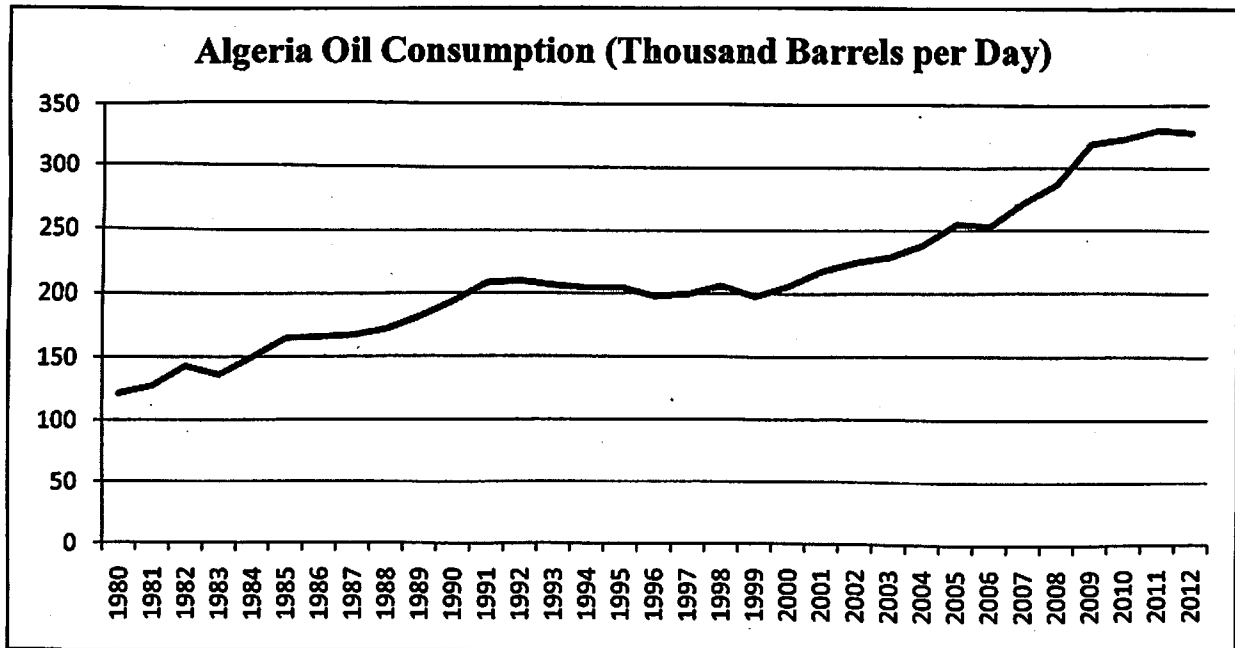


Figure 23 - Algeria Oil Consumption

⁶ Source: BP Statistical Review of World Energy

⁷ Source: EIA

1.4.2.3. Algeria Oil Market Overview

Algeria's refining sector is made up of three large coastal refineries with terminal access to the Mediterranean market, and two smaller inland plants linked to local oilfields at Adrar and HassiMessaoud. The country has a total capacity of 456,000 barrels per day (b/d), well over half of which is provided by the 300,000b/d Skikda plant on the north east coast close to the Tunisian border. Of the two other coastal refineries, one is located in the capital Algiers (54,243b/d) and another at Arzew (60,000b/d) in Oran Province.

Algeria possesses 12.2 billion barrels of proven crude oil reserves and produces around 1.2 million barrels of crude per day, out of which 649,000 bpd is domestically refined. Algeria's largest oil company is Sonatrach which is ranked 18th largest oil company in the world by Forbes.

Algeria's economy depends heavily on its exports of crude oil. 35% of Algeria's GDP depends upon its oil and gas sector and is two third of its exports. The country's oil and gas employs a workforce of more than 120,000. The country's earnings from energy exports amounted to USD 63.5 billion in 2013, a 10 percent fall from that in 2012.

In an attempt to reverse its declining output, country recently invited bids for 31 fields and offered tax incentives and other benefits to foreign multinationals.

The petrochemical sector is expected to improve in 2014 with the startup of Sonatrach's 1 million mt/year methanol complex and expansion project at Arzew.

Further, Sonatrach is planning to add four more refineries in Algeria and the country could soon turn into a net exporter of methanol and certain polymers.

Terrorist attacks, in particular at BP's In Amenas gas plant, are creating security concerns for investors, further fuelled by the armed conflict in neighboring Mali. Most likely, these events will push state hydrocarbons regulator ALNAFT to postpone the long-expected offshore licensing round in order to wait for improved investor sentiment. BMI forecast that oil production will rise from estimated 1.845mn barrels per day (b/d) in 2012 to 1.901mn b/d in 2016 as ambitious new projects, mostly located in the Berkinebas in, come on stream. Production will steadily decline afterward to reach around 1860mn b/d in 2020.

The Algerian Parliament in January 2013 approved a new national hydrocarbons law that reforms some of the more unwelcome policies that were established in 2005. BMI believe that while it creates strong exploration incentives, the new production tax regime remains unclear and burdensome, and could deter some companies from entering the market. Additionally, increased state ownership, especially in downstream and midstream, is creating further uncertainty for investors.

1.4.2.4. Operating Risks Associated

- Limited democratic system
- Growing terrorist activities

1.4.3. Angola

Capital: Luanda

Population: 19,088,106 (July 2014 est.)

Currency: Kwanza (AOA)

GDP Real: 5.6% (2013 est.)

1.4.3.1. Introduction

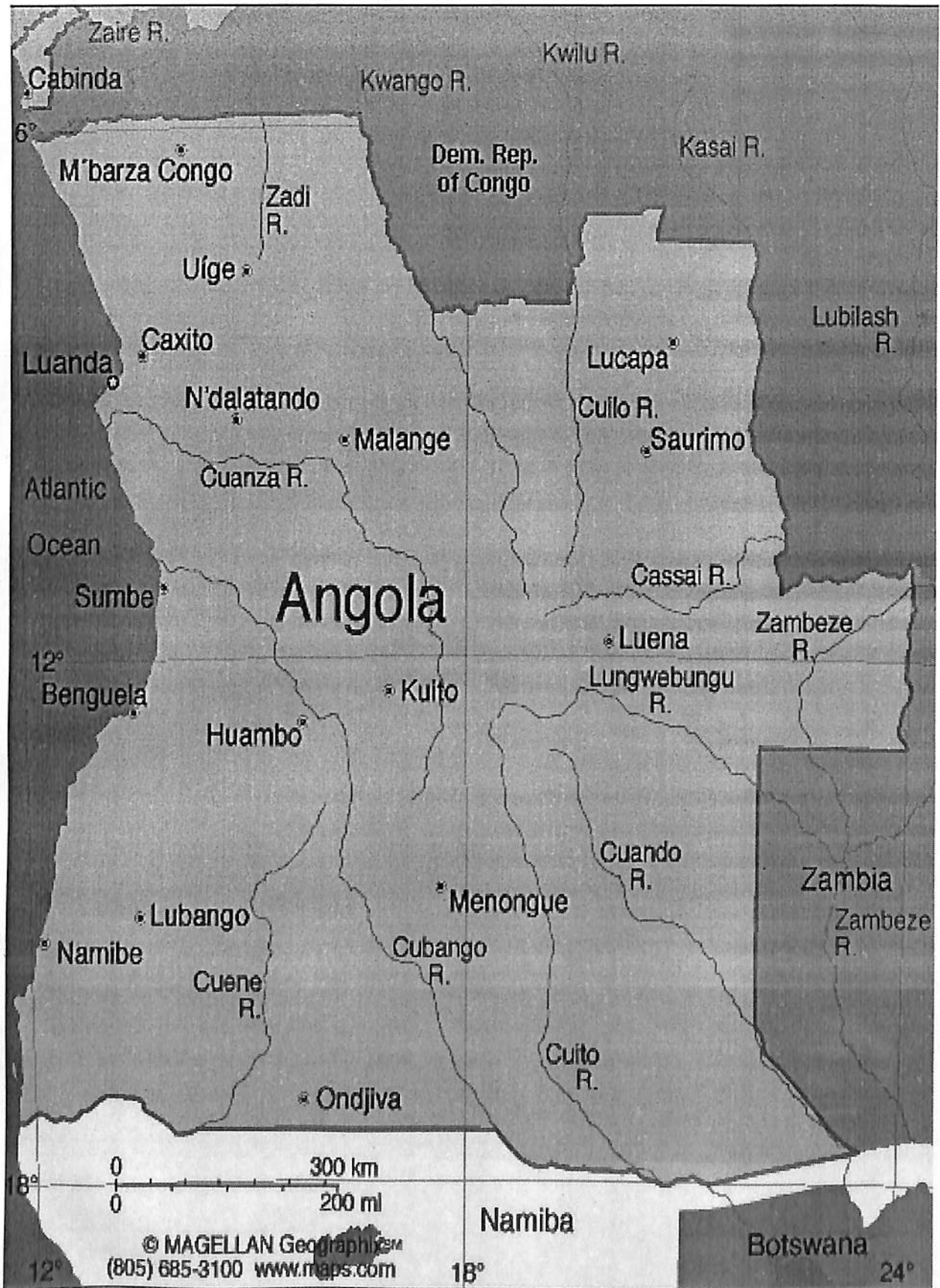
Angola is still rebuilding its country since the end of a 27-year civil war in 2002. Peace seemed imminent in 1992 when Angola held national elections, but fighting picked up again in 1993. Up to 1.5 million lives may have been lost - and 4 million people displaced - during the more than a quarter century of fighting. President DOS SANTOS pushed through a new constitution in 2010; elections held in 2012 saw him installed as president.

Geography

The total area of Angola is around 1,246,700 sq km. Angola falls in Southern Africa, bordering the South Atlantic Ocean, between Namibia and Democratic Republic of the Congo. Angola shares its borders with Democratic Republic of the Congo 2,511 km, Republic of the Congo 201 km, Namibia 1,376 km, Zambia 1,110 km.

National Flag





1.4.3.2. Angola Crude Oil Production⁸

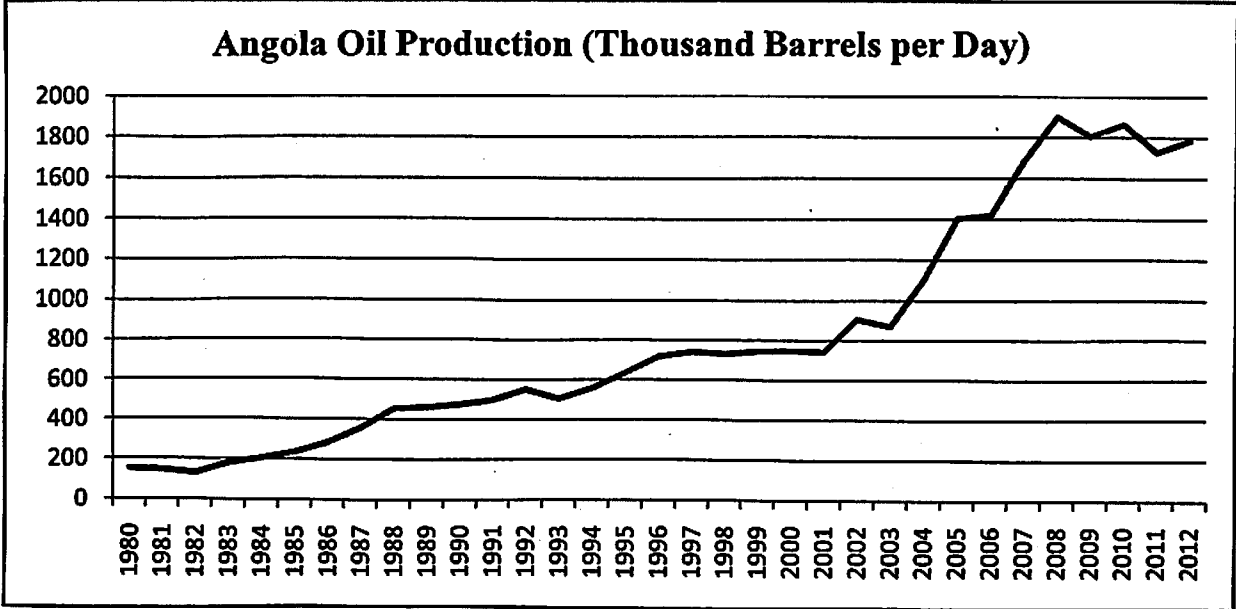


Figure 24 - Angola Oil Production

1.4.3.3. Angola Crude Oil Consumption⁹

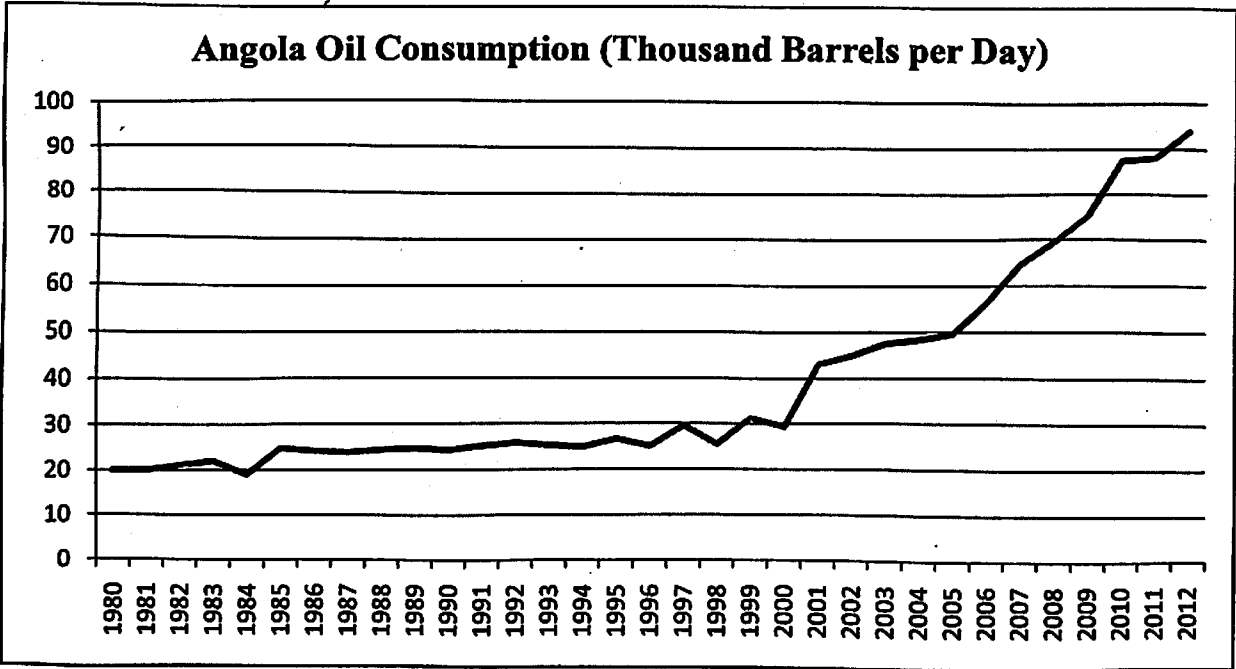


Figure 25 - Angola Oil Consumption

⁸ Source: BP Statistical Review of World Energy

⁹ Source: EIA

1.4.3.4. Angola Oil Market Overview

Angola currently has only one refinery, which was built in 1958. The plant, located in Luanda, is 91.6% owned by Sonangol, with remaining stakes owned by Portugal's GALP (0.44%), through Petrolgal, and private investors (7.96%). Prior to Sonangol's US\$600mn acquisition of Total's stake in the refinery in 2007, the French major owned a 64.1% share in FinaPetróleos de Angola – the owner of the plant - and Sonangol owned another 34%, with the remaining stakes in the hands of private investors. Following the acquisition of Total's entire stake in the plant, the ownership of a larger share of the facility was opened up to smaller investors.

Angola's oil ministry, Botelho de Vas concelos , also revealed plans for a third refinery via a statement to the ANGOP press agency. Vicente gave some additional detail on the project by saying that it would be entirely private, and that the state would promote an investment in the town of Soyo, in the northern province of Zaire, for a 200,000b/d facility. Given the difficulties the authorities have had so far in attracting investment for SonaRef, BMI see little chance of this third project being finalized in the foreseeable future.

Consumption of refined products in Angola remains relatively low due to low levels of economic development across large segments of the population, but it is increasing steadily. In 2011, total consumption of oil products was approximately 88,000 BBL/d, up substantially from 75,300 BBL/d in 2009. Transportation fuel prices are among the lowest in the world due to state subsidies that have been in place for years; subsidies which equaled 7.8 percent of GDP in 2011 (the equivalent of 90 percent of the government's public investment spending).

1.4.3.5. Operating Risks Associated

2. Internal conflicts and regional tensions
3. Social unrest

1.4.4. Libya

Capital: Tripoli

Population: 6,244,174 (July 2014 est.)

Currency:Libyan Dinar

GDP Real:-5.1% (2013 est.)

1.4.4.1 Introduction

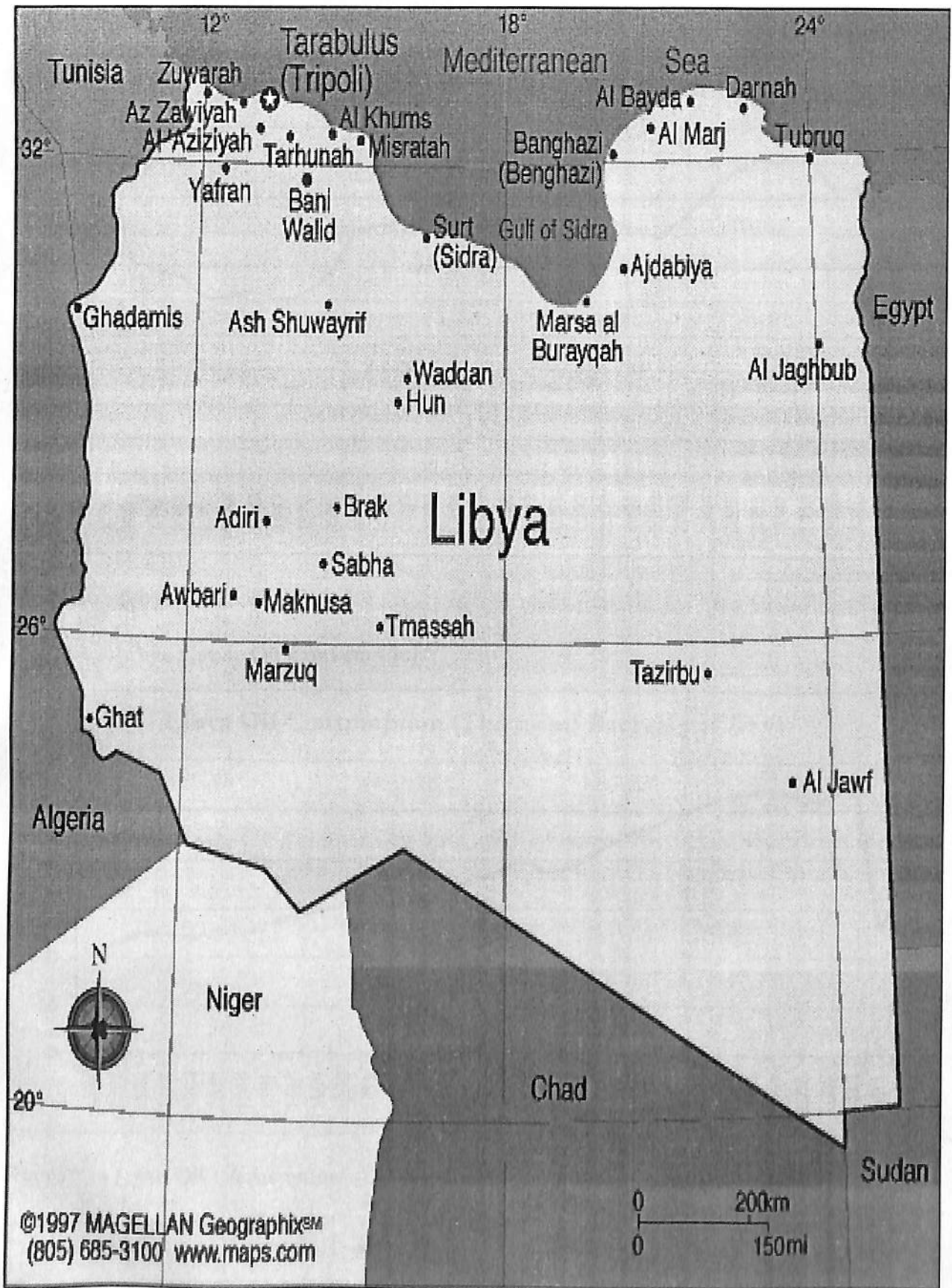
The Italians supplanted the Ottoman Turks in the area around Tripoli in 1911 and did not relinquish their hold until 1943 when defeated in World War II. Libya then passed to UN administration and achieved independence in 1951. Following a 1969 military coup, Col. Muammar al-QADHAFI assumed leadership and began to espouse his political system at home, which was a combination of socialism and Islam. Unrest that began in several Middle Eastern and North African countries in late 2010 erupted in Libyan cities in early 2011. QADHAFI's brutal crackdown on protesters spawned a civil war that triggered UN authorization of air and naval intervention by the international community. After months of seesaw fighting between government and opposition forces, the QADHAFI regime was toppled in mid-2011 and replaced by a transitional government. Libya in 2012 formed a new parliament and elected a new prime minister.

Geography

The total area of Libya is around 1,759,540 sq km. Libya falls in Northern Africa, bordering the Mediterranean Sea, between Egypt, Tunisia, and Algeria. Libya shares its borders with Algeria 982 km, Chad 1,055 km, Egypt 1,115 km, Niger 354 km, Sudan 383 km, Tunisia 459 km.

National Flag





1.4.4.2.Libya Crude Oil Production¹⁰

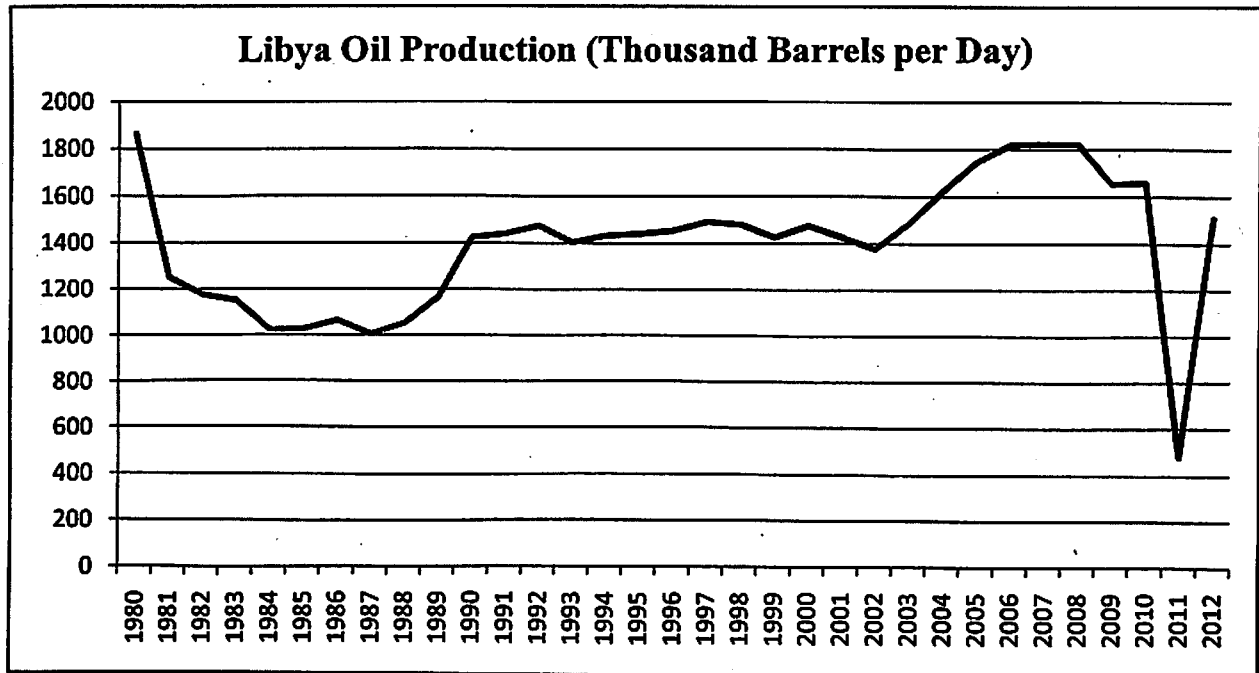


Figure 26 - Libya Oil Production

1.4.4.3.Libya Crude Oil Consumption¹¹

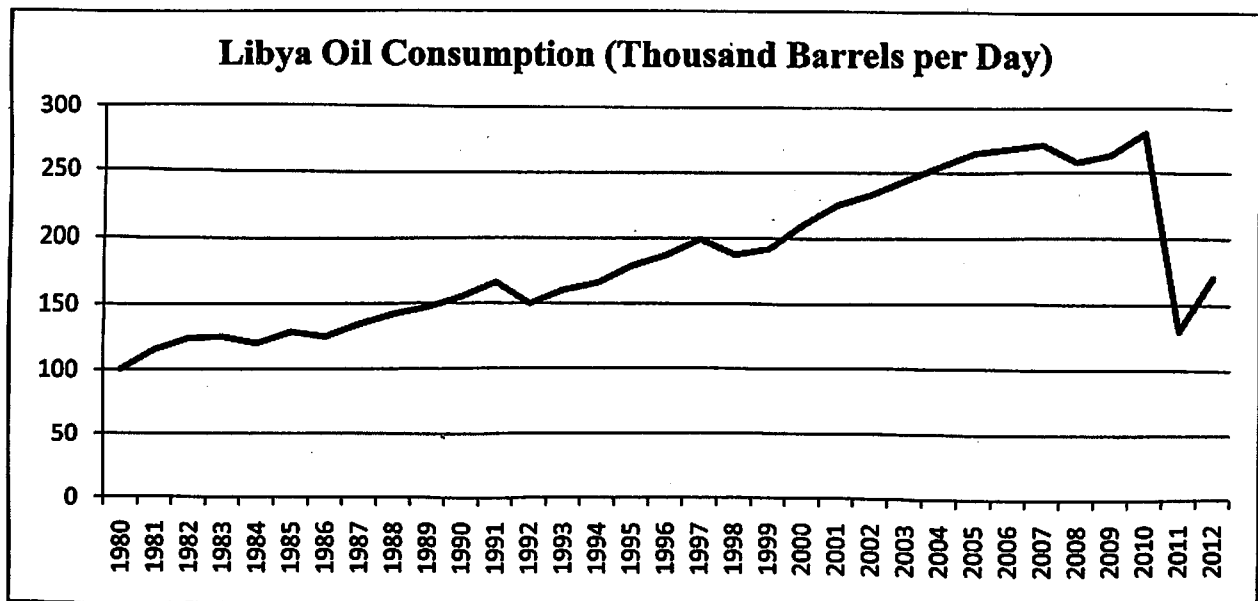


Figure 27 - Libya Oil Consumption

¹⁰ Source: BP Statistical Review of World Energy

¹¹ Source: EIA

1.4.4.4.Libya Oil Market Overview

Libya produced an estimated 1.65 million barrels per day (bbl/d) of mostly high-quality light, sweet crude oil prior to the onset of unrest in February 2011. Libyan oil and natural gas exports suffered a near-total disruption in the months of intense fighting to follow, as the minimal and sporadic oil production that did occur was mostly consumed domestically.

Libyan oil production began its resurgence in September 2011, following the deposition of Col.Mu'ammarr al-Qadhafi's regime and the gradual consolidation of control over most parts of the country by the Transitional National Council (TNC) and affiliated rebel militias. Crude oil production was estimated to have recovered to at least 1.4 million bbl/d by May 2012, as the impressive pace of the sector's recovery exceeded the expectations of most industry analysts. Nonetheless, there are significant downside as well as upside risks to the outlook for Libyan oil production due to continued uncertainty about security conditions, state cohesion, political institutions, the return of foreign capital and expertise, contract terms, and industry oversight.

The Libyan economy's dependence on hydrocarbons suggests that the continued recovery of the energy industry will be an important determinant of the country's near-term economic fortunes. According to the U.S. Department of State, oil accounted for approximately 95 percent of Libya's export earnings, 75 percent of its government receipts, and 25 percent of its gross domestic product prior to the political upheaval of 2011.

According to Oil and Gas Journal (OGJ), Libya had total proven oil reserves of 47.1 billion barrels as of January 2012 – the largest endowment in Africa, and among the ten largest globally. Close to 80 percent of Libya's proven oil reserves are located in the eastern Sirte basin, which also accounts for most of the country's oil output. Libyan oil is generally light (high API gravity) and sweet (low sulfur content).

Oil and gas consumption is set to return to pre-war levels gradually because damage to infrastructure is likely to lead to lower domestic demand from power generation. However, over the longer term, reconstruction efforts are likely to drive economic growth and oil demand higher.

1.4.4.5.Operating Risks Associated

2. Political tensions existing in the country
3. Islamic militant movements

1.4.5. Egypt

Capital: Cairo

Population: 86,895,099 (July 2014 est.)

Currency: Egyptian Pound

GDP Real: 1.8% (2013 est.)

1.4.5.1. Introduction

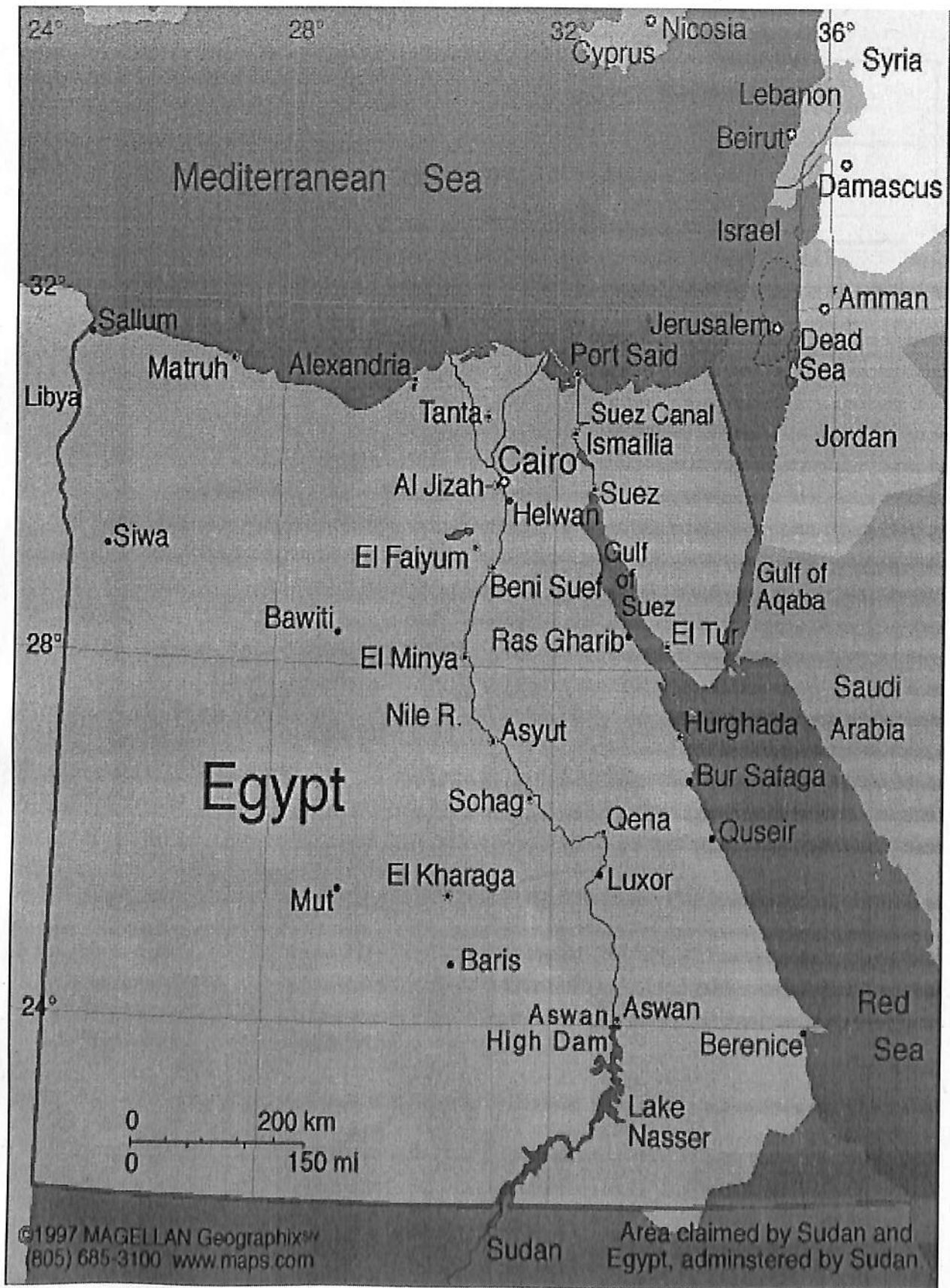
The regularity and richness of the annual Nile River flood, coupled with semi-isolation provided by deserts to the east and west, allowed for the development of one of the world's great civilizations. A unified kingdom arose circa 3200 B.C., and a series of dynasties ruled in Egypt for the next three millennia. The last native dynasty fell to the Persians in 341 B.C., who in turn were replaced by the Greeks, Romans, and Byzantines. It was the Arabs who introduced Islam and the Arabic language in the 7th century and who ruled for the next six centuries. The completion of the Aswan High Dam in 1971 and the resultant Lake Nasser have altered the time-honored place of the Nile River in the agriculture and ecology of Egypt. The government has struggled to meet the demands of Egypt's population through economic reform and massive investment in communications and physical infrastructure. Inspired by the 2010 Tunisian revolution, Egyptian opposition groups led demonstrations and labor strikes countrywide, culminating in President Hosni MUBARAK's ouster. Egypt's military assumed national leadership until a new parliament was in place in early 2012; later that same year, Mohammed MURSI won the presidential election. Following often violent protests throughout the spring of 2013 against MURSI's government and the Muslim Brotherhood (MB), and massive anti-government demonstrations, the Egyptian Armed Forces (EAF) intervened and removed MURSI from power in mid-July 2013 and replaced him with interim president Adly MANSOUR.

Geography

The total area of Egypt is around 1,001,450 sq km comprising of 995,450 sq km of land and 6,000 sqkm of water. Egypt falls in the Northern Africa, bordering the Mediterranean Sea, between Libya and the Gaza Strip, and the Red Sea north of Sudan, and includes the Asian Sinai Peninsula.

National Flag





1.4.5.2.Egypt Crude Oil Production¹²

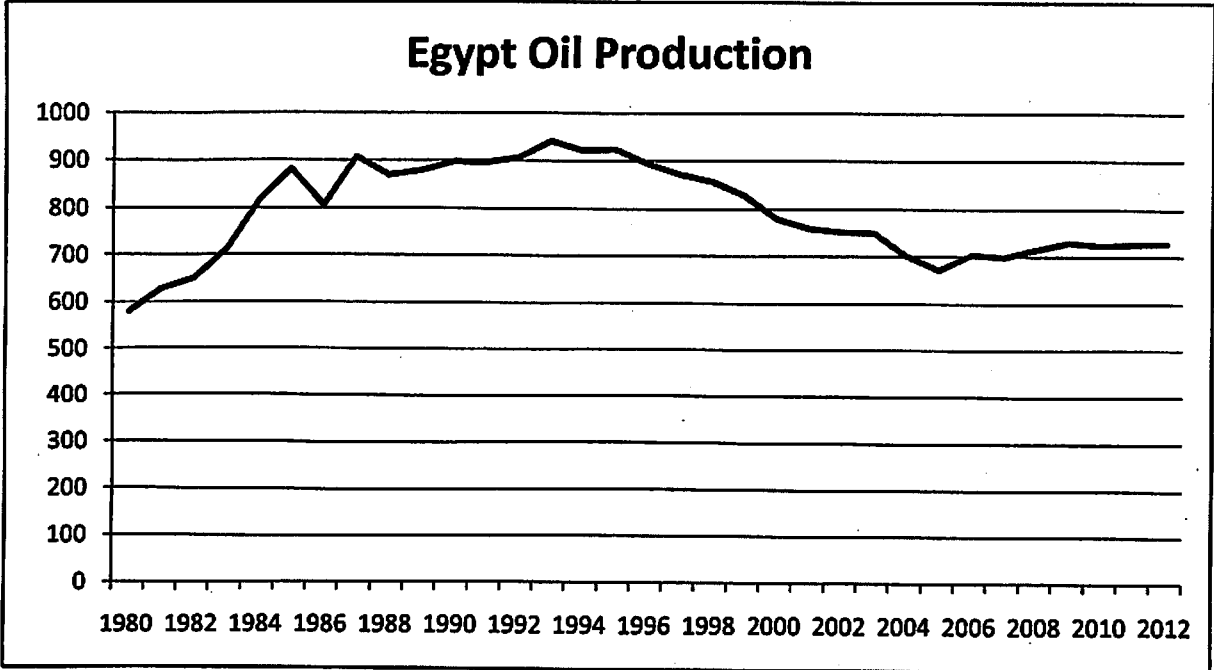


Figure 28 - Egypt Oil Production

1.4.5.3.Egypt Crude Oil Consumption¹³

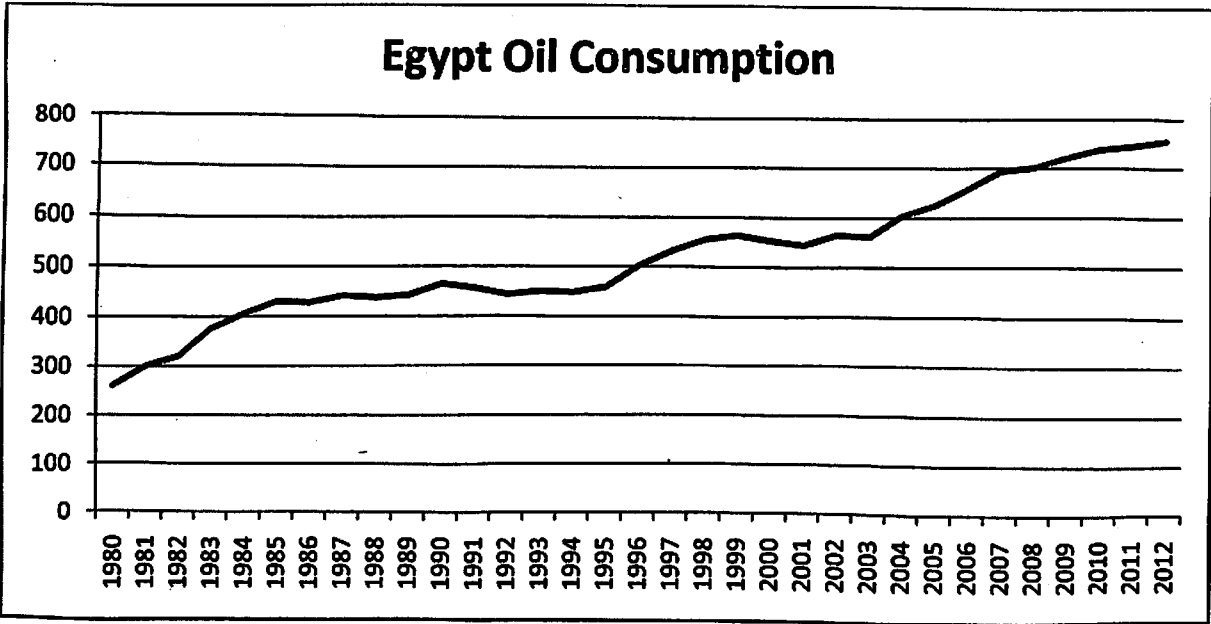


Figure 29 - Egypt Oil Consumption

¹² Source: BP Statistical Review of World Energy

¹³ Source: EIA

1.4.5.4.Egypt Oil Market Overview

The petroleum industry plays a key role in the Egyptian economy. It is one of four main sources of foreign exchange with Egypt being currently an oil exporter. Egyptian oil production comes from four main areas: the Gulf of Suez, the Western Desert, the Eastern Desert, and the Sinai Peninsula. In addition to its role as an oil exporter, Egypt has strategic importance because of its operation of the Suez Canal and Sumed (Suez-Mediterranean) Pipeline. These are two routes for export of Persian Gulf oil. The Sumed pipeline is an alternative to the Suez Canal for transporting oil from the Persian Gulf region to the Mediterranean. The 200-mile pipeline runs from AinSukhna on the Gulf of Suez to SidiKerir on the Mediterranean.

Egypt has eight refineries with a total capacity of 775,835 barrels per day (b/d). The OGI estimates capacity to be somewhat lower, at 726,250b/d. Even at this lower figure, Egypt has the largest refining sector in Africa, ahead of the nearest competitors Nigeria, South Africa and Algeria. The country's two major refining centers are Alexandria and Suez, which in 2009 accounted for 36% and 27% of the country's total crude distillation capacity respectively.

1.4.5.5.Operating Risks Associated

2. Political tensions
3. Corruption risks

1.5 Oil Logistics

1.5.1 Oil Carriers

Generally used oil tanker terminology

Tanker type	Deadweight tons	Approximate capacity (barrels)
Panamax	60,000 - 100,000	440,000 - 730,000
Aframax	80,000 - 120,000	850,000 - 880,000
Suezmax	120,000 - 200,000	880,000 - 1,500,000
VLCC	200,000 - 320,000	1,500,000 - 2,350,000
ULCC	320,000+	2,350,000+

Table 3 – Oil Carriers

1.5.2. Major Oil Trade Routes

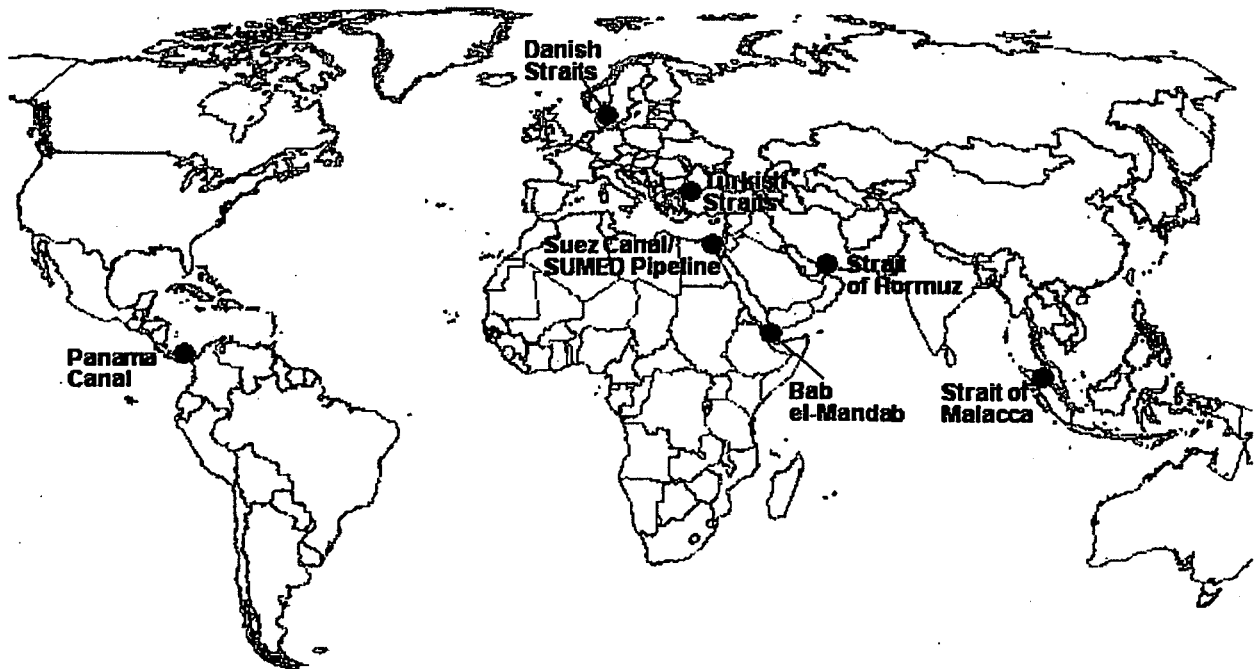


Figure 30 – Major Oil Trade Routes

World oil chokepoints for maritime transit of oil are a critical part of global energy security. About half of the world's oil production moves on maritime routes. Chokepoints are narrow channels along widely used global sea routes, some so narrow that restrictions are placed on the size of the vessel that can navigate through them. They are a critical part of global energy security due to the high volume of oil traded through their narrow straits.

By volume of oil transit, the Strait of Hormuz, leading out of the Persian Gulf, and the Strait of Malacca, linking the Indian and Pacific Oceans, are two of the world's most strategic chokepoints.

The international energy market is dependent upon reliable transport. The blockage of a chokepoint, even temporarily, can lead to substantial increases in total energy costs. In addition, chokepoints leave oil tankers vulnerable to theft from pirates, terrorist attacks, and political unrest in the form of wars or hostilities as well as shipping accidents that can lead to disastrous oil spills. The seven straits highlighted in this brief serve as major trade routes for global oil transportation, and disruptions to shipments would affect oil prices and add thousands of miles of transit in an alternative direction, if even available.

1.5.2.1. Strait of Hormuz

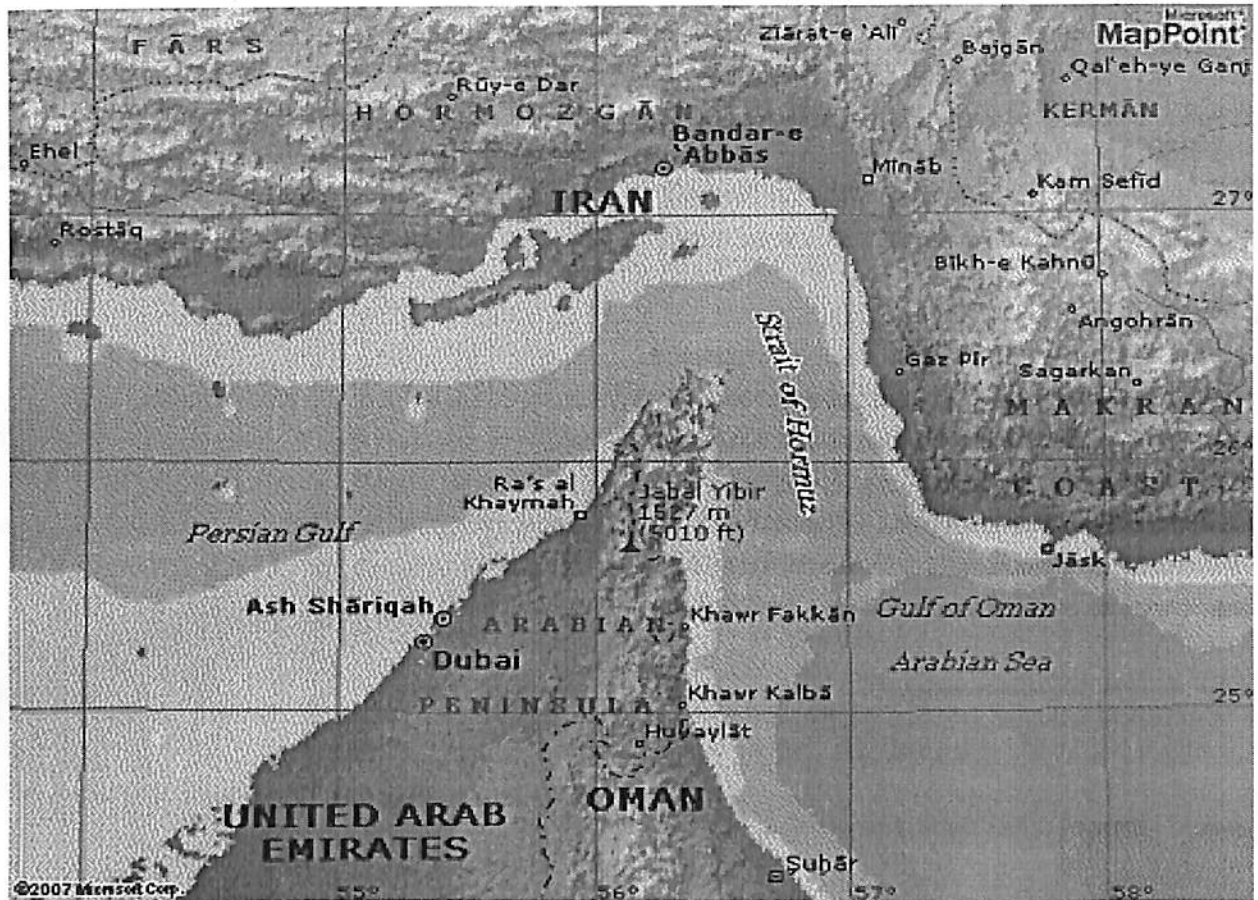


Figure 31 – Strait of Hormuz

Located between Oman and Iran, the Strait of Hormuz connects the Persian Gulf with the Gulf of Oman and the Arabian Sea. The Strait of Hormuz is the world's most important oil chokepoint due to its daily oil flow.

At its narrowest point, the Strait is 21 miles wide, but the width of the shipping lane in either direction is only two miles, separated by a two-mile buffer zone. The Strait is deep and wide enough to handle the world's largest crude oil tankers, with about two-thirds of oil shipments carried by tankers in excess of 150,000 deadweight tons.

Most potential options to bypass Hormuz are currently not operational. Only Iraq, Saudi Arabia, and the United Arab Emirates (UAE) presently have pipelines able to ship crude oil outside of the Gulf, and only the latter two countries currently have additional pipeline capacity to circumvent Hormuz. At the start of 2012, the total available pipeline capacity from the two countries combined, which is not utilized, was approximately 1 million bbl/d.

1.5.2.2. Strait of Malacca



Figure 32 - Strait of Malacca

The Strait of Malacca, linking the Indian and Pacific Oceans, is the shortest sea route between the Middle East and growing Asian markets. The Strait of Malacca, located between Indonesia, Malaysia, and Singapore, links the Indian Ocean to the South China Sea and Pacific Ocean. Malacca is the shortest sea route between Persian Gulf suppliers and the Asian markets—notably China, Japan, South Korea, and the Pacific Rim. Oil shipments through the Strait of Malacca supply China and Indonesia, two of the world's fastest growing economies.

At its narrowest point in the Phillips Channel of the Singapore Strait, Malacca is only 1.7 miles wide creating a natural bottleneck, as well as potential for collisions, grounding, or oil spills. According to the International Maritime Bureau's Piracy Reporting Centre, piracy, including attempted theft and hijackings, is a constant threat to tankers in the Strait of Malacca, although the number of attacks has dropped due to the increased patrols by the littoral states' authorities since July 2005.

Over 60,000 vessels transit the Strait of Malacca per year. If the strait were blocked, nearly half of the world's fleet would be required to reroute around the Indonesian archipelago through

Lombok Strait, located between the islands of Bali and Lombok, or the Sunda Strait, located between Java and Sumatra.

1.5.2.3. Suez Canal

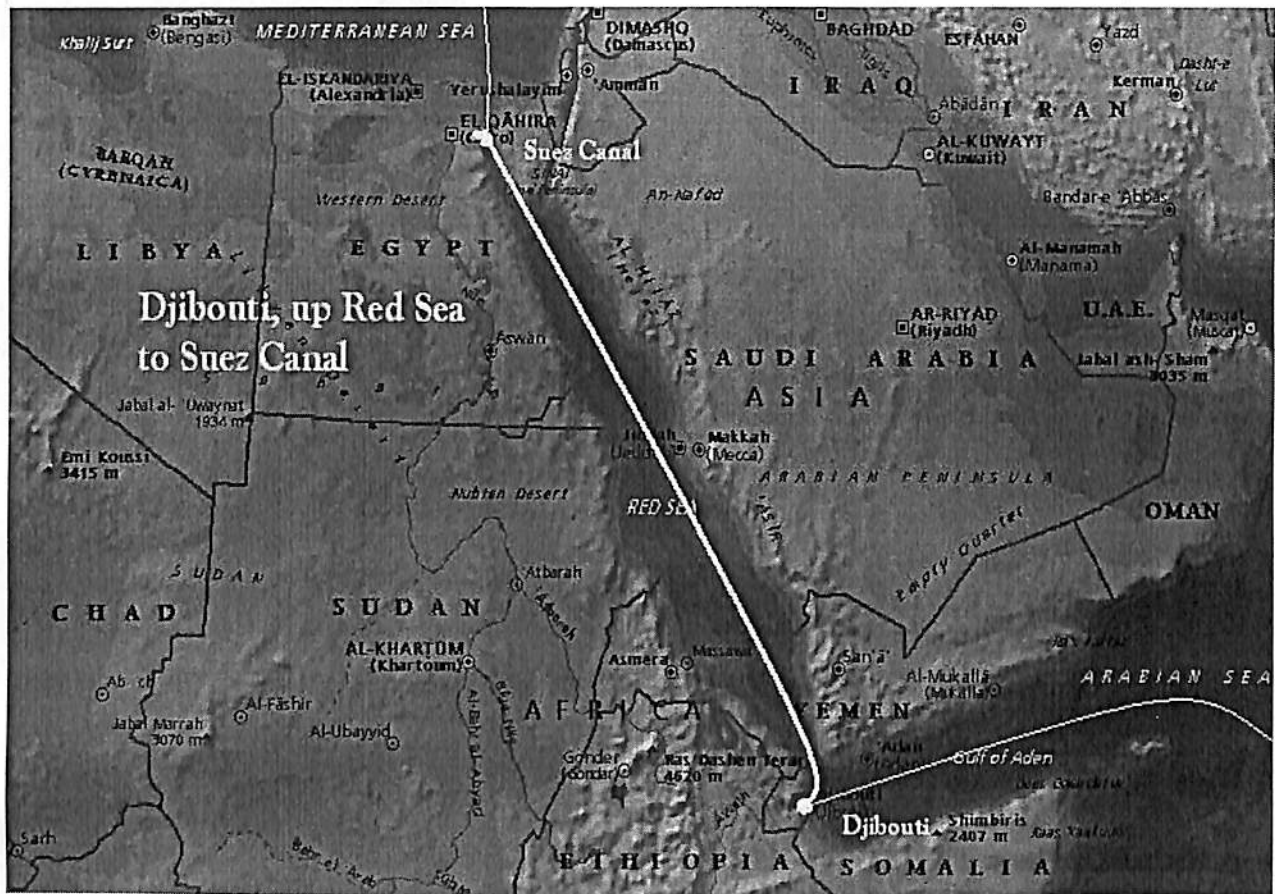


Figure 33 – Suez Canal

The Suez Canal is located in Egypt and connects the Red Sea and Gulf of Suez with the Mediterranean Sea. In 2012, oil (both crude oil and refined products) and LNG accounted for 24 and 5 percent of total Suez cargoes, measured by cargo tonnage, respectively. The Canal is unable to handle Ultra Large Crude Carriers (ULCC) and fully laden Very Large Crude Carriers (VLCC) class crude oil tankers. The Suezmax was the largest ship capable of navigating through the Canal until 2010 when the Suez Canal Authority extended the depth to 66 feet to allow over 60 percent of all tankers to use the Canal, according to the Suez Canal Authority.

In 2012, about 2.97 million bbl/d of total oil (crude oil and refined products) transited the Suez Canal in both directions. This is the highest amount ever shipped through the Canal and made up about 7 percent of total seaborne traded oil. The majority of the oil was sent northbound (1.66 million bbl/d) toward European and North American markets, and the remainder was sent southbound (1.32 million bbl/d) mainly toward Asian markets. Southbound oil flows increased

by around 540,000bbl/d in 2012 compared to the previous year mainly because of the restart of oil production in Libya in 2012 following the civil war. Southbound oil flows from Libya through Suez quadrupled in 2012.

1.5.2.4. Bab el-Mandab



Figure 34 – Bab el- Mandeb

The Bab el-Mandab is a chokepoint between the Horn of Africa and the Middle East, and a strategic link between the Mediterranean Sea and Indian Ocean. It is located between Yemen, Djibouti, and Eritrea, and connects the Red Sea with the Gulf of Aden and the Arabian Sea. Most

exports from the Persian Gulf that transit the Suez Canal and SUMED Pipeline also pass through the Bab el-Mandab.

The Bab el-Mandab is 18 miles wide at its narrowest point, making tanker traffic difficult and limited to two 2-mile-wide channels for inbound and outbound shipments. Closure of the Strait could keep tankers from the Persian Gulf from reaching the Suez Canal or SUMED Pipeline, diverting them around the southern tip of Africa, adding to transit time and cost. In addition, closure of the Bab el-Mandab would mean that oil entering the Red Sea from Sudan and other countries could no longer take the most direct route to Asian markets. This oil would instead have to go north into the Mediterranean Sea through other potential chokepoints, such as the Suez Canal and SUMED Pipeline.

1.5.2.5. Turkish Straits

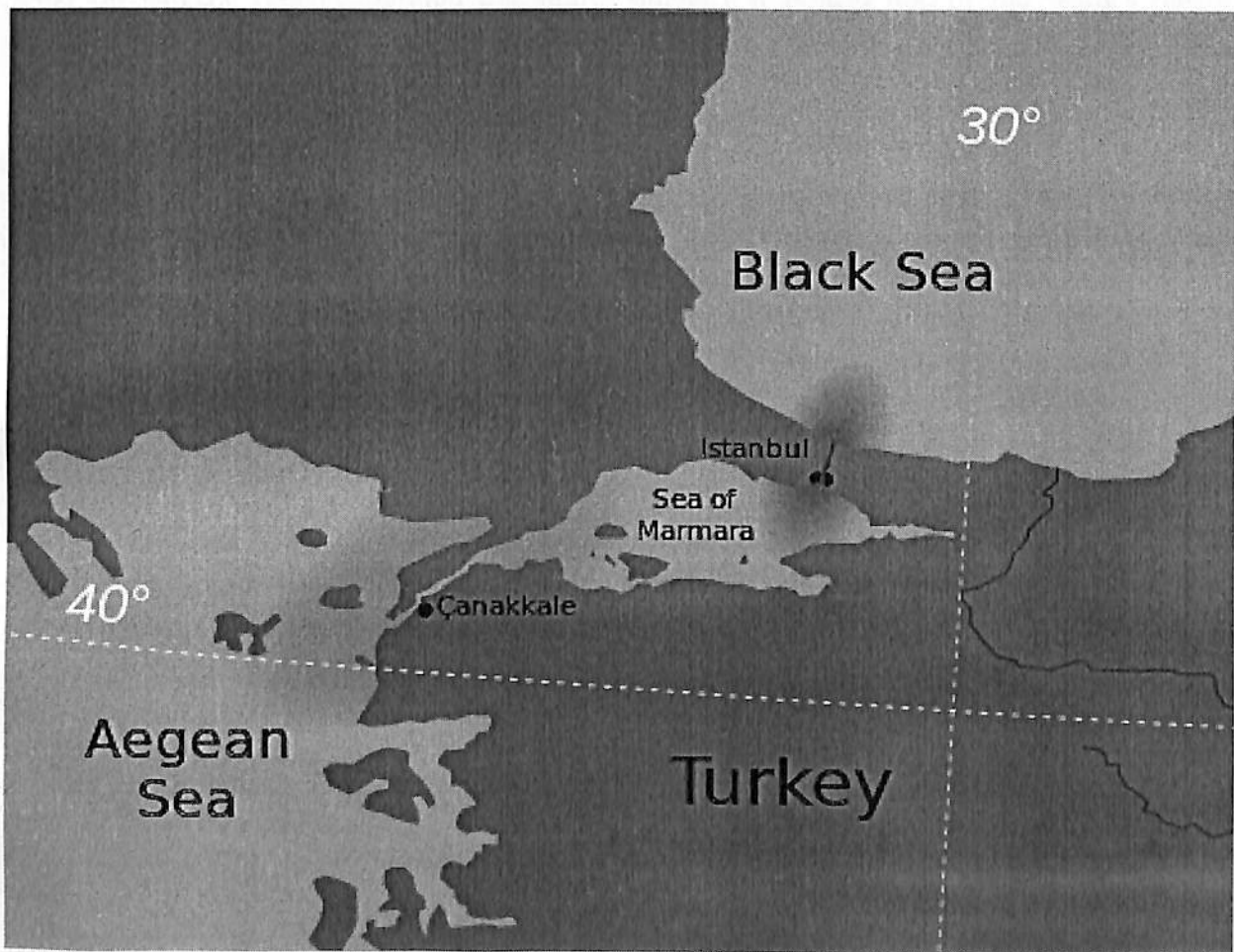


Figure 35 – Turkish Strait

Increased oil exports from the Caspian Sea region make the Turkish Straits one of the busiest and most dangerous chokepoints in the world supplying Western and Southern Europe. The

Bosporus and Dardanelles are the Turkish Straits and divide Asia from Europe. The Bosporus is a 17-mile long waterway that connects the Black Sea with the Sea of Marmara, and the Dardanelles is a 40-mile long waterway that links the Sea of Marmara with the Aegean and Mediterranean Seas. Both are located in Turkey and supply Western and Southern Europe with oil from the Caspian Sea Region.

Oil shipments through the Turkish Straits decreased from over 3.4million bbl/d at its peak in 2004 to 2.6million bbl/d in 2006 as Russia shifted crude oil exports toward the Baltic ports. Traffic through the Straits increased again as crude production and exports from Azerbaijan and Kazakhstan rose in recent years.

Only half a mile wide at its narrowest point, the Turkish Straits are one of the world's most difficult waterways to navigate due to its sinuous geography. With 50,000 vessels, including 5,500 oil tankers, passing through the straits annually it is also one of the world's busiest chokepoints.

Turkey has raised concerns over the navigational safety and environmental threats to the Straits. Commercial shipping has the right of free passage through the Turkish Straits in peacetime, although Turkey claims the right to impose regulations for safety and environmental purposes. Bottlenecks and heavy traffic also create problems for oil tankers in the Turkish Straits. While there are no current alternate routes for westward shipments from the Black and Caspian Sea region, there are several pipeline projects in various phases of development underway.

1.5.2.6.Panama Canal

The Panama Canal is an important route connecting the Pacific Ocean with the Caribbean Sea and Atlantic Ocean. The Canal is 50 miles long, and only 110 feet wide at its narrowest point called Culebra Cut on the Continental Divide. Over 14,000 vessels transit the Canal annually, of which more than 60 percent (by tonnage) represent United States coast-to-coast trade, along with United States trade to and from the world that passed through the Panama Canal.

Closure of the Panama Canal would greatly increase transit times and costs adding over 8,000 miles of travel. Vessels would have to reroute around the Straits of Magellan, Cape Horn and Drake Passage under the tip of South America.

The relevance of the Panama Canal to the global oil trade has diminished, as many modern tankers are too large to travel through the canal. Some oil tankers, such as the ULCC (Ultra Large Crude Carriers) class tankers, can be nearly five times larger than the maximum capacity of the canal. The largest vessel that can transit in the Panama Canal is known as a PANAMAX-

size vessel (ships ranging from 60,000 to 100,000 dead weight tons in size and no wider than 108 ft.)

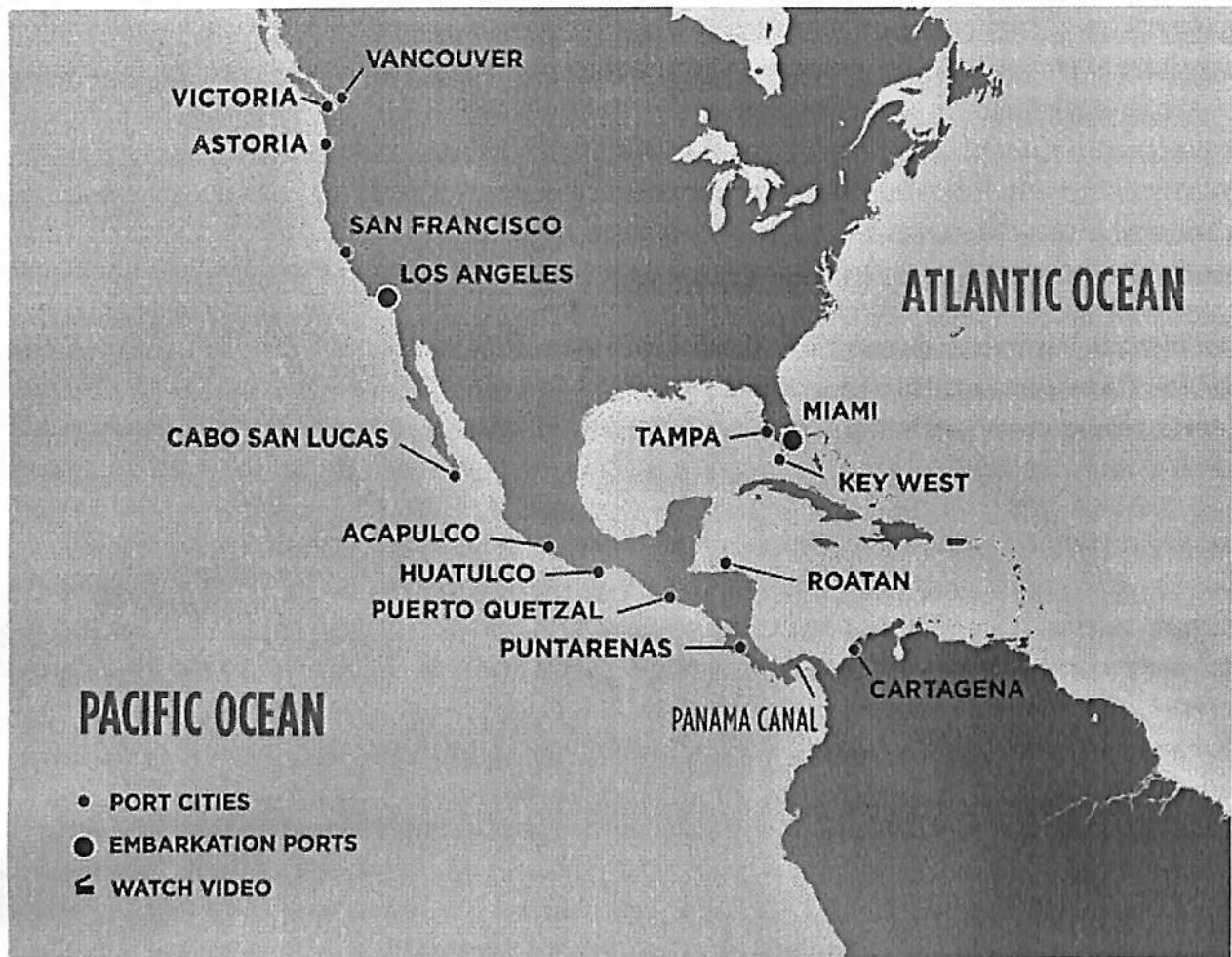


Figure 36 – Panama Canal

In order to make the canal more accessible, the Panama Canal Authority began an expansion program to be completed by the end of 2014. However, while many larger tankers will be able to transit the canal after 2014, some ULCCs will still be unable to make the transit.

2. LITERATURE REVIEW

World primary energy consumption grew by 1.8% in 2012, well below the 10-year average of 2.6%. Consumption in OECD countries fell by 1.2%, led by a decline of 2.8% in the US (the world's largest decline in volumetric terms). Non-OECD consumption grew by 4.2%, below the 10-year average of 5.3%. Global consumption growth was below average for each fossil fuel and for nuclear power; regionally growth was below average everywhere except Africa. Oil remains the world's leading fuel, at 33.1% of global energy consumption¹⁴.

"India targeting deep water potential"¹⁵ published in the year 2000 mentioned about the then thought deep water potential of India and also the scenario of the India upstream sector including NELP.

The exploration and production activities in 2002 of West Africa underlined the potential of the area to become one of the most significant oil producing centers of the world. Many new discoveries on a huge scale drew attention along with many areas being developed for commercial production. The recoverable reserves of Chinguetti in Mauritania were estimated at 110 MMbbl. Plans included a fresh look at Guinea's basin which were unlicensed and open for exploration. Political conditions, lack of suitable technology being some of the deterrents. Amni International, ChevronTexaco, Shell, Canadian Natural Resources, ExxonMobil, StatOil were some of the major players in the African Region. Discoveries of vast magnitude along with improvement in technology led to significant offshore drilling success in the years 2001- 2003¹⁶.

The world's major oil-consuming nations, led by the USA, China and the Western European countries, are keenly interested in the development of African oil reserves, making huge bids for whatever exploration blocks become available and investing large sums in drilling platforms, pipelines, loading facilities and other production infrastructure. Indeed, the pursuit of African oil has taken on the character of a gold rush, with major companies from all over the world competing fiercely with one another for access to promising reserves. This 'oil rush' has enormous implications both for African oil producers and for the major oil-importing countries. For the producing countries it promises both new-found wealth and a potential for severe internal discord over the allocation of oil revenues (or 'rents'); for the consuming countries, it entails growing dependence on imports of a vital substance from a region of chronic instability, with obvious national security overtones¹⁷.

India has considered Sudan and Angola as prospective oil trade partners. As India's economy expands, the national government is looking into exploring new oil sources, particularly in the

¹⁴ BP Statistical Review of Energy 2013

¹⁵ "India also targeting deepwater potential", *Offshore*, 16 (2000)

¹⁶ "West African offshore activity promises huge petroleum potential", *Offshore*, 46-48 & 81(2003)

¹⁷ Michael Klare & Daniel Volman, "The African 'Oil Rush' and US National Security", *Third World Quarterly*, Vol. 27, No. 4, 609 – 628 (2006)

African continent, where Chinese oil companies are continuing to outdo their Asian rivals. Indian politicians are concerned that their government has failed to live up to its promise of promoting Indian-African trade relations. Bureaucracy is believed to be blocking credit lines¹⁸. Africa Refiners Association and the World Bank will work on a study to determine investments that would allow domestic refiners to develop a refining industry in sub-Saharan Africa. It is stated that the study has been conducted as refiners from India and the Middle East are interested in owning a share of African refineries¹⁹.

The bullish entry of China and India in the African oil industry is changing the traditional relationship between Africa and the West. It gives Africa a powerful platform from which to negotiate. The investments of China and India are due to their rapidly growing economies and increasing demand for fuel and electricity. The most well publicized destination for Asian foreign investment was Sudan. The entry of Chinese interests into the Nigerian market brings Asian companies into more direct competition with the established order²⁰.

India Oil & Gas Report from BMI forecasts that the country will account for 13.21% of Asia Pacific regional oil demand by 2015, while providing 10.41% of supply. Regional oil use of 21.42mn barrels a day (b/d) in 2001 will reach an estimated 27.11mn b/d in 2010, then rises to around 30.64mn b/d by 2015. Regional oil production was around 8.35mn b/d in 2001, and average an estimated 8.91mn b/d in 2010. It is set to decrease slightly to 8.89mn b/d by 2015. Oil imports are growing rapidly, because demand growth is outstripping the pace of supply expansion. In 2001, the region was importing an average of 13.07mn b/d. This total will have risen to an estimated 18.20mn b/d in 2010, and is forecast to reach 21.75mn b/d by 2015. They see production peaking at around 950,000b/d by 2013. Oil consumption is forecast to increase by 4-5% per annum to 2015, implying demand of 4.05mn b/d by 2015. The import requirement would therefore be approximately 3.12mn b/d by the end of the forecast period²¹.

Nigeria is vastly affected from the crude theft. The illicit trade causes harm not only to the country, but also to international trade. The vast majority of the global oil industry works within the bounds of existing law. Seen from a broader perspective, Nigerian oil theft can look like a small, ugly anomaly, and in many ways it is. Foreign governments may prefer to do nothing. Nigeria must take the lead in combating oil theft from within its own borders. The four-point framework offered in this report provides an opportunity for engaged states to take first steps against Nigerian oil theft, through intelligence-gathering and analysis; Nigerian efforts to build

¹⁸ "AFRICA - INDIA: Sluggish on Trade Promises", *Africa Research Bulletin: Economic, Financial & Technical Series*, Vol. 47 Issue 12, 18935C-18936A (2011)

¹⁹ Joanna Franco, "African Refiners and World Bank to Study Sub-Saharan Refining Capacity", *Global Refining & Fuels Report*, Vol. 12 Issue 10, p31-31 (2008)

²⁰ "China, India boost African status", *African Business*, Issue 317, 30-32 (2006)

²¹ *India Oil & Gas Report*, BMI, 1-101 (2009)

international confidence; international efforts to clean up aspects of the trade taking place outside Nigeria; and a Nigerian government multi-point, multi-partner strategy for addressing oil theft²².

²² Christina Katsouris and Aaron Sayne, "Nigeria's Criminal Crude: International Options to Combat the Export of Stolen Oil", 1-85 (2013)

3. OBJECTIVES AND NEED FOR STUDY

The objective of this study is to find out the potential of African crude in India considering the given below factors:

- Crude availability
- Crude quality
- Transportation costs

S. S. S. S. S.
25/4/2014

India is the sixth largest consumer of oil in the world and the ninth largest crude oil importer. India's oil and gas sector contributes over 15% to the Gross Domestic Product (GDP). However, due to huge demand-supply gap in oil and gas in India, it imports more than 60% of its crude oil requirement.

Further, oil consumption in India is projected to enhance by 4-5% per annum to 2015, indicating a demand of 4.01 million b/d by 2015. As per the Business Monitor International (BMI) forecast, India will account for 12.4% of Asia Pacific regional oil demand by 2015, while satisfying 11.2% of the supply.

The oil industry can be divided into three major components: upstream, midstream and downstream. The upstream segment comprises Exploration and Production (E&P) activities. The midstream segment is involved in storage and transportation of crude oil and natural gas. The downstream segment is engaged in refining and production of petroleum products, and processing, storage, marketing and transportation of commodities such as crude oil and natural gas.

In India crude oil is produced Onshore and Offshore. Onshore fields are in Assam/Nagaland, Arunachal Pradesh, Gujarat, and Tamil Nadu/ Andhra Pradesh. Oil India Limited (OIL) and Oil and Natural Gas Commission (ONGC) have the onshore field for crude oil production. Offshore production occurs at Bombay High run by ONGC and Private/Joint Venture companies.

India has 20 refineries²³ out of which —17 are in the public sector and three in the private sector. The total number of retail outlets of Public Sector Oil Marketing Companies in 2010 was 36462. The total numbers of LPG consumers of Public Sector Oil Marketing Companies in 2010 were 114.952 million²⁴.

The estimated crude oil reserves of India as on 31.03.2012 stood at 759.59 MT²⁵. The state-wise estimated reserves of crude oil in India as on 31.03.2011 and 31.03.2012 is shown as under.

²³ Source- Energy Statistics 2013

²⁴ Source- Energy Statistics 2013

²⁵ Source- Energy Statistics 2013

Major Players:

Public sector corporations dominate the Indian exploration and production sector. In terms of the percentage share in total production Oil and Natural Gas Corporation (ONGC) accounts for the highest share.

The second major player in the sector is also a public sector undertaking Oil India Limited (OIL). Both of these undertakings account for about more than 70% of the total market. The remaining share of the pie is cluttered with various private players in the market. Names of the key players in the oil and gas industry in India are Oil India Ltd., Oil and Natural Gas Commission, Indian Oil Corporation, Hindustan Petroleum Corporation Ltd., Bharat Petroleum Corporation Ltd., Gas Authority of India Ltd., Reliance Industries Ltd., Essar Oil, Adani Gas, Petronet LNG, Cairn Energy, Shell, British Gas and BP.

Few of the SEZs in this sector are Reliance Petroleum SEZ, Mangalore SEZ in Karnataka, Gujarat Hydrocarbons and Power SEZ and Nagarjuna Oil Corporation in Tamil Nadu.

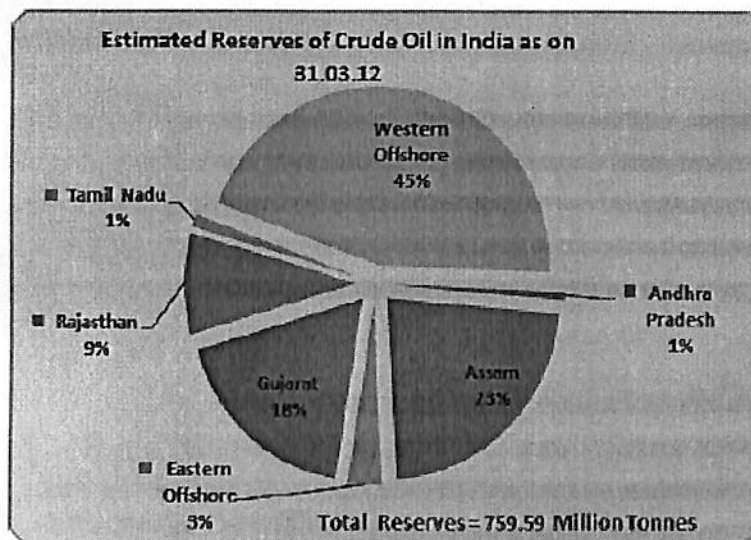


Figure 37²⁶ – Estimated Reserves of Crude Oil in India, 2012

Since India being the largest importer of crude, diversification of oil sources has become more urgent as western sanctions on crude imports from Iran due to its nuclear projects has already made Indian refiners to look for alternatives. Iran which was once India's second biggest supplier of crude, no longer holds the same position. Supplies from Libya and Sudan were also disrupted due to disturbances in both the countries.

²⁶ Source- Energy Statistics 2013

Considering all the above factors, there is a need to diversify the crude sources of India. In this regard, finding the potential of other countries in Indian refineries has become a must to find out the other sources of crude.

4. RESEARCH METHODOLOGY

The research methodology followed in the project is descriptive research methodology. Descriptive research is used to obtain information concerning the current status of the phenomena to describe “what exists” with respect to variables or conditions in a situation. The method involved is the preparation of research structure followed by the collection of secondary and primary data. The study of data is done to extract the relevant data and then the conclusions are drawn.



Figure 38 – Research Methodology

Data Collection

There are several ways of collecting the data. The methods of data collection followed in the research are:

- Observation Method
- Insights from experts (mentors)
- Internet
- Articles, periodicals, journals

The secondary data was collected from internet via various sources like that of the BP statistical review. The main data source was BMI reports on countries and websites like CIA, Indexmundi, Petroleum Africa, Africa-oil-gas, Infoplease.com etc.

5. DATA ANALYSIS

5.1.SWOT Analysis of Indian Oil and Gas Industry (Table 4)

<u>Indian O&G Industry SWOT Analysis</u>						
			<u>Opportunities</u>			<u>Threats</u>
		a	Deliberalisation of Gasoline and Plans to liberate Gas Prices		a	Cut on Oil Product Subsidies
		b	Increasing LNG Imports		b	Oil accounts for 30% of total consumption
		c	Bidding of Foreign companies in First Shale Gas licensing		c	Lack of infrastructure for importing Gas
	<u>Strength</u>					
1	India is 5th biggest Energy consumer		1 with b and c			1 with b and c
2	Major natural gas discovers by domestic companies		2 with a and c			2 with a , b and c
3	Presence of reserves of Unconventional gas		3 with a and c			3 with a and b
	<u>Weakness</u>					
1	O&G sector dominated by state controlled enterprises		1 with a and c			1 with a, b and c
2	Regulated pricing discouraging foreign companies participation		2 with a, b and c			2 with b and c

5.2.SWOT Analysis: Nigeria

STRENGTHS



- Large hydrocarbon resources with relatively high prospectivity
- Production has been recovering since the launch of the amnesty programme and there is potential for significant growth in both oil and gas .

WEAKNESSES



- Uncertainty over the future of the Petroleum Industry Bill (PIB)
- Inefficient downstream sector, with utilization rates as low as 20%

OPPORTUNITIES



- Efficient monetization of associated gas, which could replace flaring and help develop the country's power sector.
- Interest of multinationals

THREATS



- OPEC quotas
- Continued insecurity in the Niger Delta and piracy in the Gulf of Guinea
- Increased thieves ' activity triggering numerous outages

5.3.SWOT Analysis: Algeria

STRENGTHS



- Strong position state-owned Sonatrach is the world's 11th largest oil company and the fourth largest gas producer and exporter
- The country has strong institutions and technocrats in the petroleum industry

WEAKNESSES



- Sonatrach has failed to build on its technological lead to expand internationally and bolster its image abroad
- output from these fields has been erratic, it remains unclear whether production at these fields is declining

OPPORTUNITIES



- Algeria's territory remains relatively unexplored. Known basins still have large undiscovered reserves
- The mooted reform of Algeria's hydrocarbons law is expected to improve the business environment

THREATS



- The attack at BP's In Amenas Plant revealed serious security concerns for the country's hydrocarbon market
- The country has proven immune to the 'Arab spring' but there is still a risk that the situation could become much more volatile in coming years

5.4.SWOT Analysis: Angola

STRENGTHS



- Angola's hydrocarbons industry is set to enjoy strong growth in the coming years

WEAKNESSES



- OPEC quotas constrain the country's output
- Projects, in the upstream and downstream, suffer significant and continuous delays which are a real drag on the industry

OPPORTUNITIES



- Exploration in subsalt basins, which share similar characteristics to subsalt acreage in Brazil, could boost oil reserves and production
- The creation of the National Oil Agency, should bring more transparency and efficiency to the sector

THREATS



- There is widespread and high-level corruption

5.5.SWOT Analysis: Lbiya

STRENGTHS



- Proven hydrocarbons reserves
- Well-developed oil infrastructure
- Important supplier of light sweet crude

WEAKNESSES



- Political and regulatory uncertainty

OPPORTUNITIES



- Much underexplored acreage remains, especially offshore
- Reconstruction of damaged facilities

THREATS



- Security threats, both from domestic tensions between the east and the west, and from external threats emanating from an emboldened Islamic militant movement

5.6.SWOT Analysis

STRENGTHS



- Significant natural gas resource base, particularly offshore Well-developed oil infrastructure
- Sovereignty over a key oil and gas transit channel - the Suez Canal

WEAKNESSES



- Once a significant oil exporter, Egypt has now become a net oil importer

OPPORTUNITIES



- Exploration in the Western Desert has uncovered new, significant hydrocarbons volumes

THREATS



- Policy uncertainty following the 2011 revolution could potentially see foreign investors leave the country - although there is no indication of this as yet

6. CONCLUSION

Africa' share of global oil and gas production has stood at 10% and 6% respectively over the past 24 months. 2012 has been marked by extensive activity by IOCs and expectations that the mostly unexplored acreages of African coasts would yield substantial resources.

By analyzing current market trend and on the basis of large amount of oil and gas resources holding of African countries, it can be forecasted that in the coming years, African region will be a huge investment hub for companies all over the world. African region will have an ample amount of opportunities in it.

India- Africa relations are good and India imports its one fifth of crude from Africa. The trade route for oil could be from straits of Malacca for the eastern Indian ports and Suez Canal or Cape of Good Hope for western Indian ports. The most economical route for importing oil would be from Cape of Good Hope or from Suez canal. If the maritime traffic at the Suez Canal is to avoided then the Cape of Good Hope route could be followed.

During Iran sanctions, substitution was done from Africa. India needs to diversify its crude resources and should not remain completely depended on the Middle East alone as this could create problems for India. At the time of Iran sanctions and the Syria war, India faced a lot of problems. India's energy security is also not at a very great position to support India at the time of crisis.

By importing crude from African countries, India can also ensure that even if there is a blockage of Suez canal, India can have another economical route via the Cape of Good Hope.

The crude produced by the African countries is of sweet nature with less than 0.5% sulfur content and maximum API gravity of 63. So it could be processed in the Indian refineries without any hassle.

Though political instability is a issue in Africa but still India could look forward to the conditions as the conditions in Africa seems to be improving any many oil majors are making their set up in African countries for exploration and production.

From the Indian point of view, IOCL has recently ordered for 3 million barrels per day of crude from West Africa.

Africa has a huge potential towards oil and gas industry and India is a major importer of crude in the world. So there lies a huge potential for the African Crude in India.

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