

CHAPTER FOUR

ECONOMICS OF OIL PRODUCTION

In this chapter, the activities of the various oil companies such as the NOC and its affiliated companies are examined. The chapter also discusses the various stages in the exploration and drilling for oil in Libya. In the concluding parts of the chapter, the oil refinery system as well as the processing and distribution of gas which has also been increasing in importance in recent years in terms of its contribution to Libya's GDP will be examined.

4.1 The national oil corporation and affiliated company :

In 1970, the Government disbanded the "General Libyan Oil Authority" and created in its place the "National Oil Authority" to be an instrument of popular authority for the control and supervision of the people's oil wealth. This Authority is the sole owner of several operating joint-stock companies and is a share-partner in varying proportions, in other companies.

NOC was re-organized under a decision taken by the General Secretariat of the General People's Congress, No.10 of 1979. The reorganized was meant to enable NOC to achieve the goals of the transformation development plans in the oil sector. It was designed to support the national economy through the increase management and investment of the oil wealth inside and outside Libya through its fully owned companies, or in partnership with others.

In 1986, the General People's Committee issued its decision No.158 concerning the re-allocation of the authorities of the Secretariat of Petroleum. A considerable part of these authorities were delegated to NOC.

Therefore, as mentioned at the end of previous chapter, NOC performs its duties through its fully owned companies in refining, processing and domestic international marketing companies to various service companies. Moreover, NOC performs some of its activities through partnership with foreign exploration, production and specialized oil service companies.

According to the various NOC annual reports during 1990-1995, the totally owned companies by NOC are:

1)The Arabian Gulf Exploration Company.

The AGECEC was once known as British Petroleum (BP), and it was nationalized in two stages, first in 1971 and then in 1973. Its operations are confined to the exploration and production of crude oil and natural gas. Its best known oil field is the **El-Saris** field, one of the ten biggest in the world and containing the largest reservoir of oil in Libya. It exports crude oil through **El-Hariqa** harbor in the city of Tobruk. The major pipeline through which oil is pumped is about 520 kilometers long.

2)The Umm El-Jawabi Company.

Before its nationalization in 1974, it was known as the American Overseas Oil Company. It undertakes exploration and research and production of crude oil in the areas allotted to it, which include the **El-Nafura** oil field, so far the largest productive field in sector 51. This company owns 25 storage tanks, holding 500,000 barrels of crude oil exported from Ras Lanuf harbor through a pipeline network of different caliber's, about 632 kilometers long.

3)The Zawiya Company Oil Refining.

It runs the Zawiya Refinery which was established in 1974 and obtained its oil source from **Alhamadah Alhamrah** fields. Agreement to build Zawiya refine was

concluded with the Italian "Senam-Brugetti" Company, on the basis of a productive capacity of 60,000 barrels a day. The refinery was opened on El-Fateh of September, 1974. In the same year, its capacity was doubled by the expansion of its facilities and it started to produce 120,000 barrels a day of various oil derivatives such as cooking gas, heating and lighting fuel, naphtha for petrochemical industries, gasoline to run internal combustion engines, aircraft fuel, kerosene for heat and light, as well as fuel oil for heat, electricity generating and ships.

Among other totally owned companies are El - Brega Company for oil Marketing, replacing the ESS and Shell Companies which between them had shared the distribution of oil products before this activity was nationalised in 1970 and the National Drilling Company which operates for the benefit of the National Oil Authority of the Agip-North Africa and Middle East Company and of the Arabian Gulf Exploration Company.

On the other hand, the partner Companies of NOC are:

1)The Esso-Standard (Libya) Company.

The Government owns 51% of the company. Its activity is restricted to exploration, drilling and production of crude oil and natural gas. Among its best known fields are **Nasir, El-Raquba, Maqil, Lahib, Dura, Murada and El-Hutayba**, which was considered the most important gas field in Libya in terms of production and reserves. Production is exported by way of Marsa El-Burayqa harbor through a 700 kilometer network of pipelines of different caliber.

The company also runs a small refinery with a total production of 10600 barrels day, as well as operating a rapid training center set up in Marsa El-Brega where labor is trained in the various skills necessary to operate and maintain the oil installations.

2)The Libyan Oasis Oil Company.

This is one of the oil companies which used to work for three American Organization Marathon, Continental and Amerada. Its best known field include **El-Waha, Jalu, El-Daffa, Bahi and El-Dhahra**. The first of these produces almost 350000 barrels a day followed by Jalu with 280000 and El-Dhahra which produces about 90000. Average monthly production for all the Company's oil field is approximately 22 million barrels. Crude oil is exported through Sidra harbor after being pumped from 19 storage tanks with a capacity of 55 million barrels. The pipeline network linking the fields to the terminal harbor covers 877 kilometers.

3)The Occidental (Libya) Company.

Its most productive fields are **Ujala** and **Intisar**. Average daily production is 350,000 barrels. This Company owns gas operation plants at the Intisar oil field an El-Zuwaytina harbor, through which most of the crude oil is exported after being pumped through about 950 kilometers of different caliber pipes. The harbor has some 15 large crude storage tanks for oil ready for export, with a capacity of handling giant tankers.

4)The Libyan Mobil Company.

This company produces more than 35 million barrels of oil per year, exported via Ras Lanuf harbor some 375 kilometers to the west of Benghazi. The harbor offers four tanker jetties and 13 storage tanks with a crude capacity of half a million barrels each.

5)The Agip (North Africa and Middle East) company Limited.

This company works in the field of exploration drilling and production of crude oil and gas in 50% partnership with the National Oil Authority.

6)The National Methanol Company.

This company owns a methanol plant in Marsa El-Burayqa ,producing 1000 metric tons a day of methanol, which is used as a raw material in industries such as plastics, paint, dyes, wood glues and so forth.

4.2 Exploration and drilling :

The foreign companies right to monopolize the exploration and drilling activities has led to the increased number of agreements were concluded. For example, in 1968 alone, a total of 137 agreements were signed (NOC,1995).

As soon as they found oil, exploration activity slowed down because they diverted their attention to the depletion of the known reserves. The following are some of the most important features of oil activities before 1969 :

1) The concentration of foreign companies on drilling exploratory wells.

The concentration on developing producing wells rather than investing in new exploration activity.

2) Slackening of the companies exploration activities for more than eight months, contrary to the provisions of the petroleum law.

This situation, however, improved relatively during the first quarter of 1969 due to:

(i) new competitor companies starting exploration work and (ii) the discovery of new oil fields by some companies such as Agip, Wintershall and Aquitane

Since 1969 more attention has been give to exploration work in order to increase the reserves and make up for the losses caused by the high production rates. Equal sharing Agreements were signed covering new areas on land and offshore. Operating companies were also pressed through close supervision and follow-up, to

double their allocations on exploration and search for oil. These efforts were finally crowned by the establishment of National Drilling Companies.

NOC has performed through its fully owned joint venture companies, seismic surveys and has drilled exploratory wells in the sedimentary basins found in many parts of Libya extending from Cyrenaica platform to Sirt, AL Hamada, Ghadames, Murzuk and EL-Kufra basins, in addition to off-shore areas within territorial waters and the continental shelf.

The most important results of exploration activities during the twenty-five years (1970-1995) can be summarized as follows:

In Land Area:

1) 982 exploratory wells were drilled, out of which 596 or 61% were exploratory wells for new reservoirs and structures while 386 or 39% were delineation wells.

2) During the period from 1970-1995, a total of 196,269 longitudinal KM s have been surveyed in land and a total of 52,987 longitudinal KM s have been surveyed off-shore, the number of exploratory wells drilled for new fields reached 293 , out of which 135 were successful with a success rate reaching 46%.

3) Developed exploration operation in the Morzuk Basin which was considered for a long time as a low potential basin, resulted in the realization of commercial rates.

4) Huge recoverable gas reserves were found on land and off shore, the biggest of which was Attahadi discovery of Sirte Oil Company. This is in addition to other gas discoveries in the basins of Sirte, Ghadames and Morzuk which are awaiting technical studies and exploratory and delineation drilling.

Off Shore Areas:

1) During the period 1970-1995 a total of 48 exploratory wells were drilled. The first off shore discovery was made in 1971 as a result of intensive operations which resulted in the discovery of 25 oil and gas fields with a success rate of about 52%.

2) **EL Bouri**, one of the biggest oil fields in the Mediterranean. This field is considered one of the most important oil discoveries in the off-shore of Libya. It is located 125 Km north -west of Tripoli. It was discovered in 1976 and a development program is being carried out consisting of two stages:

First Stage:

- Preparation of the main production platform No.4.
- Preparation of the second production platform No.3.
- Loading and production equipment.
- Supply base.

Platform No.4 is considered to be one of the biggest platforms in the world with a body weight of 24,000 tons. It is the main platform in the EL bouri field and has the capacity to accommodate 250 employees. It is equipped with two rig facilities as well as a helicopter port, in addition to a desalination plant, oil and gas separators, flaring facilities and control equipment for production and safety. This platform was installed in its allocated position on 11 September 1986.

Development drilling on platform No.4 started in December 1987. In addition, platform No.3 was placed in position in July 1987. The installation work for the top side units was continued in preparation for the commencement of drilling and the installation of the rigs. Platform No.3 was connected to platform No.4 by an underwater 12 inch pipeline. A 16 inch pipeline was then submersed, connecting platform No.4 with the single point mooring. It is expected that the field shall

commence production during the second half of 1988. The maximum rate of production shall reach 150,000 barrels per a day.

Second Stage:

Other production platform No's 1,2 and 5 was constructed during this stage and also reasonably commercial oil potentials were for the first time confirmed in the offshore area near Benghazi.

4.3 Oil and gas production :

Oil production began in 1961 at the rate of 13,200 barrel per day. Since then production kept rising until it reached a peak of 3.0 million barrels per day in 1970 (Table 4-1). These figures reflect the production policy of the monopolistic operating companies and the weak position of the government before 1969.

Since 1969 a well studied production policy different from that of the sixties, was implemented to maintain the oil reservoir by following the latest scientific methods and practices. Accordingly, early in the seventies, production rates were reduced, production limits were set for each individual company and Regulation No.8 concerning the conservation of wealth was put into effect. By 1974 production constituted only 2.7% of the total world production.

Due to the complete adherence of Libya to the production ceiling set by **OPEC** for each member country, within the framework of a policy aiming at overcoming the existing problem of world oil market, the Libya's production rates remained unchanged. However, in order to maintain the production capability, operation and maintenance of oil installation which suffered both from long operation life and negligence, in the past by the monopolistic companies, had to continue operating for the last twenty-five years. This made it necessary to concentrate on maintenance work

and upgrade safety standards in all field and terminal locations. This, of course lead to the increase in operating costs in addition to fund allocated for the new extensions that would improve these installations to bring them up to the required technical standards. In spite of all this, the production capability has to be improved and the development of new oil discoveries has to be improved and the development of new oil discoveries has to continue in order to maintain production and oil reserve levels. As a result of these efforts of N.O.C. in developing new fields and the addition of new discoveries to the developed fields, the new developed fields and formations during the last twenty-five years 1970-1995 totaled 70 out of which 48 were developed to give 600 million barrels of oil reserves and 14.4 billion cubic feet of gas reserves.

Among the important developed fields, it is worth mentioning for example, **Messla field** which produces an average of 150,000 billion barrels a day, **Diffa field** which is now producing about 175,000 barrels a day, **Abu-Attifel field** with an average production of 155,000 barrels a day and **El- Bouri** with an average of about 45,000 billion barrels a day after the completion of the development stages. Also worth mentioning is **El Hatiba Gas field** with an average production of 180 million cubic feet a day and **Sahil field** with an average of 150 million cubic feet a day. The later will be officially inaugurated during the next years.

4.4 Oil production and revenues During 1970-1995:

Table (4-1) shows the development of exports and oil revenues derived from these exports for the period 1970-1995. The slight fall in the level of production is evident from the Table. Exports levels have not been steady particularly during the period 1973-1983 rising and falling from year to year.

The decline in production during this period reflects a combination of factors such as the oil price fall which were caused by factors beyond Libya's control. Much of the decline in export volume in early and mid 1980s as shown in Table (4-1) is as a result of Libya's decision to stay generally within its OPEC production quotas, as OPEC tried to use its market power to reverse the falling price of its oil supply. The fall in production level in 1971-1993 also reflects the consequences of such events as the nationalization of BP and the enforcement of the cut backs and embargoes decreed by Arab Oil producers in October 1973 during the Middle East war. Most observers, recognize that to continue producing at the rate of 3 to 3.5 million barrels a day as in 1970-1971, was undesirable both for technical and economic reasons. Lower rates of production were associated with higher revenues because of successive price increases since 1970. An interesting feature of Table (4-1) is the continuous growth of oil revenues. Between 1970 and 1995, government revenue from oil rose every year above the level attained in the preceding years. Finally, there was a considerable drop in average production in 1974.

The considerable drop in average production in 1974 is because OPEC reduced Libyan quota of oil production. Libya's share of OPEC production was only 7% in September 1993. The country however accounted for a third of the total fall in output in the second half of 1974. The interpretation of this phenomena reveals interesting aspects of the oil market, in which Libya has always assumed a special role because of the special characteristics of the Libyan's petroleum, where Libyan crude enjoys three advantages over Gulf or Arabian petroleum, that is its low sulfur content, high degree of API gravity (which means higher yields of the valuable light products) and Proximity to European markets.

Table (4 - 1)

Libyan Oil Production, Exports and Revenue

Year	Production (million barrel a day)	Exports (million barrel a day)	Revenue (billion US dollar)
1970	3.300	0.841	1.59
1971	2.800	0.956	2.20
1972	2.300	0.949	2.21
1973	2.200	1.161	2.04=0.68 LD
1974	1.521	1.388	5.00
1975	1.480	1.192	7.45
1976	1.933	1.711	8.24
1977	2.063	2.034	8.85=2.95 b/LD
1978	1.820	1.954	8.40
1979	2.091	2.050	15.6
1980	1.830	1.765	22.60=7.53 b/LD
1981	1.217	1.124	15.30
1982	1.136	1.052	13.90
1983	1.104	1.016	10.90
1984	1.075	0.990	10.20
1985	0.990	0.885	10.00
1986	0.984	0.750	4.40
1987	0.996	0.770	5.60
1988	1.306	0.836	5.70
1989	1.110	0.890	5.90
1990	1.350	1.130	11.40=3.8 b/LD
1991	1.520	1.360	10.20
1992	1.492	1.345	9.40
1993	1.400	1.220	7.37
1994	1.390	1.230	6.47
1995	1.430	1.265	7.21=2.40 b/LD

source: Ministry of planning. OPEC, report (various issues). OAPEEC,
Twentieth annual report,1993. Economist Intelligence; Libya,
(various issues). Middle East Economic Survey, various issues.
Unified Arab Economic Report,1994.

These advantages carry premier over the price of marker crude (Arabian light) which serves as a reference. OPEC fixes only the marker price and individual members have substantial freedom in determining and varying the premier. Prior to 1970 Libya was selling her full capacity output at prices which involved lower premier than market

condition warranted, resulting a loss in potential income. In 1974, Libya was operating well below capacity and exports were continually declining because the premium was much higher than the market value of the quality differentials. Tanker freight rates had collapsed wiping away much of the location advantage. Excess capacity in the refining industry and changes in the structure of demand for oil products reduced the attractiveness of lightness and low sulfur content. Failure to reduce the price differential by the correct amount drove Libyan exports of oil in early 1975 below one million barrels a day. The move back to two million barrels a day was achieved in middle 1975 through a price cut which seems to have exceeded the desired objective. The oil market in the second half of 1974 and during 1975 was characterized by a series of significant shifts in supplies from one exporting country to another leading in most cases to delayed and often incorrect adjustments of price differentials. These shifts and the corrosion of the price structure did not seriously threaten the solidarity of OPEC or lead to the undermining of the price floor. But there are disadvantages in an administered system of price differentials will unable the system to respond rapidly to changing market conditions where a lack of economic sophistication and detailed market information. Libya has suffered most from it and in trying to recover losses, it may have inflicted some strains on the Organization.

From 1980 to 1995, the oil supply in Libya was characterized by relatively stable production and export levels. This characteristic reflects the policy adopted during this period of fixing production. The reasons for this fixed production are two-fold. First, prices of oil have shown a tendency to fall considerably and this meant that increased production was discouraged. Second, the UN sanctions against Libya also helps to explain the decline in overall output during the 1990's.

4.5 Oil refining and processing :

Prior to 1969, the capacity was not more than 10,000 barrels a day, produced by a small refinery owned by ESS company in Marsa EL Brega oil Terminal and most of the products were used by the company itself in its operations. The refining capacity was developed thereafter until it reached the present capability of 16.7 million tonnes per year or 380,000 barrels per day; 38 times increase over the initial capacity before the revolution.

The followings are a summary of the most important projects in the field of refining and processing:

1) Zawia Refinery:

The first refinery built by N.O.C. after the dawn of the El-fateh Revolution. It went on stream on 1st September 1974 with an initial capacity of 60,000 barrels a day to satisfy the requirements of the local market. In 1971 an identical train was added, with a capacity of 60,00 barrels a day, bringing the total capacity up to 120,000 barrels a day.

The refinery has the following main units of production (capacities in barrels per day): Crude unit (120,000), Vacuum unit (7,548), Catalytic hydrotreater (16,500), Catalytic reformer (13,500), Lubes (650), Asphalt (3,500).

2) Ras Lanuf Refinery:

It is designed to process 220,000 barrels per day of crude oil. It was completed and went on stream by the end of 1984 preparations are being carried out to sign contracts to execute the succeeding expansions of the refinery.

The refinery operated by the Ras Lanuf Oil and Gas Processing Company, a subsidiary of the N.O.C. The refinery produces fuel oil, gas oil, naphtha and kerosene. Expansions to the refinery in 1955 had increased the production of benzene,

butadiene, butane and MTBE. The refinery has the capacity of producing 220,000 barrels of crude unit per day and 3,300 barrels of Ethylene a day.

3) The Ethylene plant of Ras Lanuf :

Construction execution of this huge petrochemical complex in Ras Lanuf which included the Naphtha steam cracking plant began in 1978. In spite of the difficult circumstances that accompanied the construction of the plant, especially the American embargo forced on Libya in regard to materials and equipment, the plant went on stream in April 1987. The plant produces olefins used in making various kinds of plastics and fiber glass and many other industrial products with a total capacity of about one million tonnes per year. The complex depends on stabilized naphtha produced by the Ras Lanuf Refinery. The plant also produces propylene, ethylene, tetracarbon mixture, pyrolysis gasoline and heavy fuel oil.

There is no direct use presently for ethylene, propylene and tetracarbon mixture, but these will be required later when the succeeding petrochemical units are executed. Contractual preparations are underway in this regard.

4) Tubrok Refinery:

This is designed to process 20,000 barrels per day for petroleum products. It went on stream in 1986 and it produces liquid gas, naphtha both light and heavy, domestic and aviation kerosene and heavy fuel oil. A contract was signed in August 1989 to add a unit to produce high grade lead-free gasoline.

5) Serir Refinery :

It uses Sarir crude with a capacity of 10,000 barrels per day. It went on stream at the beginning of 1988, for the purpose of supplying the Kufra power plant with 3 thousand barrels per day of diesel oil and the rest to be distributed in the area to meet

its requirements of petroleum products especially with the increase in construction activity of the Great Man -Made River.

6) Sebha Refinery :

This Refinery will be built to meet the requirement of the southern part of the country from oil products. It is designed to produce 20,000 barrels per day.

7) The Luboil Blending and packaging Unit in Zawia :

It was completed in 1977 with a capacity of 30,000 tonnes per year to meet the requirements of the local market of lubricant oils and greases. By the end of 1987 its capacity was doubled and a new line was added in the packaging section to produce one-liter cans bringing the total capacity of the unit to 20 million one-liter cans and 170 thousand 200-liter barrels. Lately, a new 4-liter can line was added.

8) Battery and Radiator fluids plant :

It was inaugurated in 1983 with a capacity of 12 million liters per year. This plant was built to meet the requirements of the local market of these products.

9) Asphalt Industry :

With the infrastructure expansion in Libya, consumption rate of asphalt increased sharply. Since this material used to be imported, two units were built to meet the local requirements, one in Zawia in 1984 and the other in Benghazi in 1982, each with an annual capacity of 202,000 tonnes of reduced crude.

4.6 Processing and transporting of gas:

Since 1969, Libya has become one of the pioneering countries in gas processing, gas liquefaction and exportation. A national company specializing in gas processing and related industries was established in Marsa El Brega in December 1979 under the name of National Petroleum Chemicals Company. The company

which has six industrial units mainly produces Methanol, Ammonia and urea. A gas line extending from Marsa El Brega to Misurata and Koms was constructed to supply the industrial complexes, power stations and cement plants along the line with their requirement of fuel gas. Studies are being carried out to extend the line to the city of Zuara.

NOC supervises through its specialized companies, seven gas plants. Among these plants are the following :

1) The first Ammonia plant.

It has production capacity of one thousand metric tonnes of ammonia per day and has a natural gas intake capacity of 600 metric tonnes per day. It has two main units; Gas sulfur separation unit and Ammonia unit.

It went on stream in July 1978. This product is used as a feed stock for making Urea fertilizer.

2) The second Ammonia plant.

It was completed and put into operation in (May) 1982 with the same production capacity as that of the first plant (one thousand metric tonnes per day) and specifications.

The purpose of its construction was to meet the market demand and to improve gas utilization.

3) The First Methanol Plant.

Its production capacity is about one thousand metric tonnes per day. The whole production is for export.

4) The Second Methanol Plant.

This plant which went on stream in (November) 1985 is an identical unit to the first plant with the same production capacity (about 1000 metric tonnes per day).

5) The First Urea Plant.

The plant which went on stream in (September) 1981 produces Urea, a basic product for making fertilizers but depends mainly on produced Ammonia (60%-80% of total production). The product capacity is 1000 metric tonnes per day and can be raised to 1,350 metric tonnes per day.

6) The Second Urea Plant.

This plant was built for better product and to utilize the Ammonia production from second Ammonia plant. The plant, which has an estimated capacity of about 1750 metric tonnes per day, went on stream in (April) 1984.

7) The Brega Gas Liquefaction Plant.

This huge plant was built in Marsa El Brega in 1970 for utilizing the associated gas which was prior to this date was wastefully burnt. The plant belongs to Sirrt Company and designed to produce 120 thousand barrels per day with an intake capacity of 600 million cubic feet per day of natural gas.

In addition to the use of gas as a feed stock for the complex plants in Brega and Ras-Lanuf, a portion of it may be utilized as a source of energy for the operation of some plants and power stations on which are currently operated by oil products.

This project was executed with the objective of supplying existing and future power stations along the coast line with their requirements of natural gas instead of using heavy fuel oil and also to be utilized by the steel and iron complex of Misurata as direct reducing agent. This system consists of two main parts: First, the 670 KM long 34 inch Brega- Musrata-Koms pipeline. This pipeline will transport gas to consumption points. It also constitutes a first step in the coastal gas pipeline which is to be constructed along the Libyan coast. It may also constitute an extension of the Arab Maghreb pipeline project. Second, the Compression plant located at the

beginning of the line in Marsa El Brega .Additionally, there are other operational and maintenance facilities.

The flow capacity of the line is about 410 million cubic feet per day . The line which was put into operation in (March) 1988, is now supplying gas to: Ras-Lanuf Ethylene Plant, Sirt Fertilizelant plant, Zletin Power Station, Sirt Power Station, Musrata Power Station, Musrata Steel and Iron Complex, Zletin Cement Factory, Leptis Cement Factory, Koms Power Station, Koms Cement Factory.

Since 1969 the control of oil and systematized exploration, production activities led to important transformations especially nationalization of the oil sector which is considered the main contributing factor that resulted in the improvement of the Libyan economy.

Moreover, the government faced hard challenges in achieving current transformation and nationalization of the Libyan economy.

Indeed, it is important to note that after 1969, many achievements have been made despite the challenges. The change in policy recommended played a major role in influencing the Libyan economy and led to exploiting the natural resource (*Brega Company,1995*).

4.7 Conclusion:

The discussion of this chapter centered on the role of the National Oil corporation and its affiliated companies, and the consequent part of these companies have played in the systematized exploration, drilling as well as the refining and processing of oil and gas in Libya. The distribution network of oil and gas has also been reviewed. NOC performs its duties listed in the laws and by laws of its inception, through its fully owned companies which vary in activity from operating and

producing companies, to refining, processing and marketing of oil companies. Controlling, systemizing of oil exploration and production activities in Libya are considered as a great achievements in Libyan oil history.