

This is the Seventh Edition of our definitive report on Libya's Oil and Gas Industry. It contains 438 pages and includes data on over 80 developed and undeveloped fields along with details of opportunities with pipelines, refineries and infrastructure.

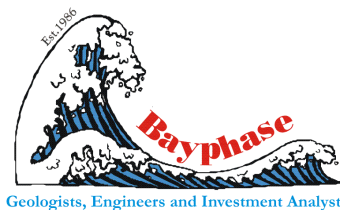


Libya

Oil and Gas Industry Strategic Report

Contents, Example Field, List of Figures, List of
Tables and Index only

By



March 2014

Seventh Edition

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Introduction

This report charts Libya's oil and gas potential and is a must for anyone interested in engaging in its oil and gas sector.

Libya's proximity to Europe, its sweet high quality crude oil, its significant gas reserves make this report a must not just for oil and gas professionals but also for those interested in assessing Libya's strategic impact on hydrocarbon supplies to the EU and the USA.

This issue includes the results of the licensing awards made since lifting of sanctions and exploration drilling conducted in license areas.

This Report is the **Seventh Edition** of Bayphase's **Libya Oil and Gas Industry Strategic Report**. It provides a comprehensive review of Libya's Oil and Gas Industry, including these elements:

- **Upstream:** Fields, Production Facilities and Exploration Potential
- **Midstream:** Pipelines, Terminals
- **Downstream:** Refineries, Petrochemical Plants, Gas Processing Plants
- **Infrastructure:** Power Generation, Transportation

Though the Report presents an industry wide assessment its main focus is Libya's upstream oil and gas fields and their production facilities. Here a basinal view of Libya has been taken with the country catergorised in to its six main sedimentary basins:

- Sirte
- Ghadames
- Murzuk
- Offshore/Tripolitania
- Cyrenica
- Kufra

The Report is supplied with a folded copy of the latest edition of our [**Libya Exploration and Production Two Map Set**](#).

The report provides analysis and enhanced data sets on over **80 oil and gas fields**; some currently in production - others undeveloped awaiting investment.

The report also examines licensing and **Exploration Potential** in all of Libya's sedimentary basins to provide an assessment of the investment likely to be expended in exploration activities and the reserves increments that could potentially result.

For one year following, purchasing customers will be supplied with any updates made to the report.

From an **Oil Reserves Perspective** the report charts Libya's proven plus probable potential remaining reserves of 67 Billion bbls.

From a **Gas Reserves Perspective** the report charts Libya's proven plus probable potential remaining reserves of 89 Trillion Standard Cubic Feet

From an **Investment Perspective** the report shows how between 46 and 81 Billion Dollars of investment will be required by Libya's oil and gas industry over the next 15 years to unlock its production potential.

We have developed a companion publication to this Report that analyses the economics associated with each of the fields we have identified here - see the [Libya Fields Financial Report](#) web page for more details.

Report History:

- i. 1st Edition October 2007 - 420 pages
- ii. 2nd Edition December 2007 - 437 pages
- iii. 3rd Edition May 2009 - 442 Pages
- iv. 4th Edition July 2011 - 450 Pages
- v. 5th Edition February 2012 - 455 Pages
- vi. 6th Edition March 2013 - 455 Pages
- vii. 7th Edition March 2014 – 438 Pages

What You Get:

- Paper Version of our current **Libya Oil and Gas Industry Strategic Report**
- Free Searchable CDRom of our current **Libya Oil and Gas Industry Strategic Report**
- Paper Version (Folded) of our current **Libya E&P Three Map Set**

The analysis carried out on the 80 fields is indicated by the field sample provided below:

1.1.1.1.1 Hofra

This field is also known as Jofra or Al Hufrah. This section refers to both the Hofra and Dahra East Fields, as they are part of the same structure.

The Hofra field was discovered by Mobil in 1958, in concession 11. In 1989 Oasis discovered the Dhara East (F) oil pool in concession 32, which subsequently proved to be part of the same structure as Mobil's Hofra discovery. It is believed that Oasis and Mobil developed their parts of the field independently, with Oasis' Dahra East coming on stream in 1962 and Mobil's Hofra a year later, in 1963.

There are three reservoir intervals present in the Hofra Field, all of which are Paleocene Carbonates, separated by shale intervals (Rabia Shale acts as a cap for the Upper Satal, Khalifah Shale seals the Az Zahrah Limestone and the Harash/Khayir Shale caps the Zaltan Limestone). The Upper Satal and Az Zahrah Limestones extend over the whole area of the field and are 130m

and 90m thick respectively. The Az Zahrah accumulation also contains a gas cap. The Zaltan Limestone is represented by high-energy facies only on the eastern side of the Dahra-Hofra High, and shales out rapidly to the West. It has a thickness of 60 to 100m.

In addition, the field also contains two minor gas bearing intervals.

The trap is structural for the Upper Satal Member, being a low relief anticline oriented northwest. However, the other two intervals are stratigraphic traps, with the Az Zahrah Limestone pinching out to the West and the Zaltan Limestone shaling out in the same direction.

The hydrocarbons are believed to have been sourced from the Sirt Shale, likely from the Maradah Trough kitchen. Oils are oversaturated, and gas caps are present. The oil initially in place is estimated at 2.8 billion barrels, while the initial reserves were 621 million barrels.

Over 170 wells have been drilled on the structure, but most are now shut in. Water is injected by three wells to support the reservoir pressure. The field also produces gas from five wells.

Key Field Data

Table 1.1: Hofra Key Field Data			
Parameter			Value
Discovery Date			1958, 1959
On-stream Date			1962, 1963
Recoverable Reserves	Original	Oil (Million Barrels)	621
		Gas (Billion Cubic Feet)	310.5
	Remaining	Oil (Million Barrels)	250 (estimate)
		Gas (Billion Cubic Feet)	125 (estimate)
Prospective Resources (Upside Exploration Potential)		Oil (Million Barrels)	50
		Gas (Billion Cubic Feet)	-
Production	Current	Oil (Barrels per day)	4,000
		Gas (Million Standard Cubic Feet per day)	2 (estimate)
	Potential	Oil (Barrels per day)	50,000 (estimate)
		Gas (Million Standard Cubic Feet per day)	25 (estimate)
Geology	Producing Horizon(s)		Upper Satal Member (Danian, Paleocene); Az Zahrah (Dahra) Formation (Paleocene); Zaltan Limestone (Paleocene)
	Rock Type(s)		Limestone (all intervals)
	Reservoir Depth (Feet)		2,660 – 2,700
	Gross Rock Volume (Million Cubic Feet)		
	Reservoir Thickness (Feet)		
	Porosity (%)		20 – 25
Fluid Properties	Oil	Gravity (° API)	29.2 – 47
		Sulphur Content (wt %)	
		Pour Point (°C)	5
		Wax Content (wt %)	
	Gas	Gas Oil Ratio (Standard Cubic Feet/barrel)	500
		Hydrogen Sulphide Content (mol %)	0.6
		Carbon Dioxide Content (mol %)	1.6
		Molecular Weight	
Existing Facilities	Subsurface	Number of Producers	5 (estimate)
		Number of Gas Injectors	-
		Number of Water Injectors	3

		Parameter	Value
	Surface	Separation Capacity (bpd)	80,000
		Compression Capacity (MMscfd)	50 (estimate)
		Acid Gas Treatment Capacity (MMscfd)	-

Commercial Data

The field is operated by Veba Oil Operations B.V., a joint venture between Petro-Canada (49% interest) and the National Oil Corporation (51% interest). The contract is to expire on 30th December 2015.

		Parameter	Value
Contract Type			Joint Venture
Contract Effective Date			
Operator			Veba Oil Operations
Equity (%)	Petro-Canada		49
	NOC		51

Investment Requirement

The operator has yet to publicise their plans for the future redevelopment of this field. Our view is that from a purely technical standpoint the field could benefit from additional investment. Whether this investment is conducted solely by Petro-Canada or with outside assistance has yet to be decided.

Below we present what we believe would be a probable redevelopment plan given the current status of the field. In our view redevelopment would be conducted in a number of stages:

- Work over and re-completion of a significant proportion of the existing producers to achieve improved reliable recovery from areas currently in production.
- Refurbishment of existing production equipment to provide a reliable production base with this followed by a production expansion to allow for additional production from the existing field and incorporation of 1 new discovery.
- Implementation of a seismic survey and assessment of the field to gather data to plan further redevelopment activities.
- Implementation of appraisal drilling and assessment of data to plan further redevelopment activities.
- Implementation of infill drilling targeting poorly drained areas of the field identified by seismic and other surveys.
- Implementation of exploration drilling to test targets identified by seismic survey.
- Development and tie-back of 1 assumed successful discovery with reserves of 50 million barrels made during the exploration phase.

The program outlined above is one that might typically be adopted in the redevelopment of any old large producing field. In addition there may well be an opportunity for tertiary recovery on

this field though this would appear to be a distant target outside of our timescale of consideration.

Project	Rationale	Time Frame (Years) ¹	Cost Estimate (Million \$) ²	
			High	Low
Subsurface				
Work Over and Re-complete existing producers and injectors	Work over and re-complete selected producers to boost production from field areas currently in production and to achieve reliable production from the existing wells; Number of wells: 5	1 - 5	15.9	29.4
Seismic Survey	Implementation of seismic survey over field area to assess redevelopment options and potential exploration targets. Includes a 600km ² 3D Survey.	2 – 4	21.2	39.2
Infill Drilling	Drilling of producers to produce from field areas currently not in production; Number of Producers: 10	2 – 3	42.4	78.4
Exploration Drilling	Drilling of exploration wells to test exploration targets; Number of Wells: 2 Exploration	4 – 6	21.2	39.2
Appraisal Drilling	Drilling of appraisal wells. Number of Wells: 2.	6 – 8	10.6	19.6
Development Drilling Discovered Field	Drilling of producers to produce from assumed discovery with 50 million barrels recoverable; Number of Producers: 5.	7 – 9	26.5	49
Subtotal			138	254.8
Surface				
Surface Facilities Rehabilitation	Refurbishment of existing facility to maintain stable production includes replacement of equipment, control systems and material where necessary.	1 - 2	31.8	58.8
Surface Facilities Expansion and Incorporation of 1 Discovery	This includes installation of well pads, gathering flow lines, inter field pipelines and modifications to the existing production system to process production from the existing field and the assumed discovery	4 - 9	233.5	431.2
Subtotal			265.3	490
Total			403	745

¹ Time frame is our expectation of when the investment will be implemented based on announcement made by operators and in the case of potential investments identified during the course of this study our assessment of potential timescale. An investment with the time frame 2 – 5 is expected to start 2 years following date of issue of this report and to be complete within 3 years.

² The cost ranges reflect the uncertainty associated with the actual work scope that will have to be implemented.

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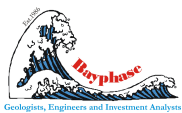
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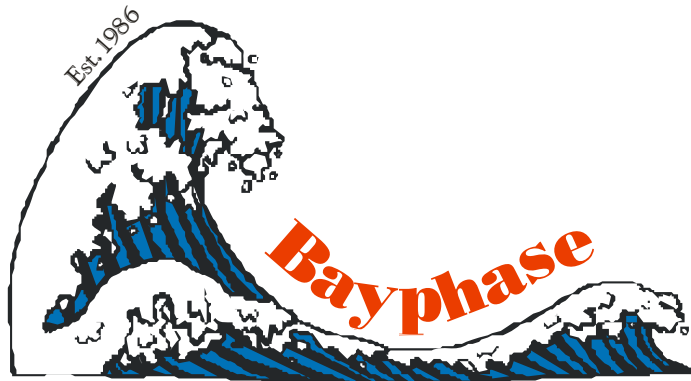
For a full list of clients see: <http://www.bayphase.com/clients.php>

Address: St George's House
Knoll Road
Camberley
Surrey
GU15 3SY

Telephone: +44 (0) 1276 682828

Fax: +44 (0) 1276 63334

Web: www.bayphase.com



Geologists, Engineers and Investment Analysts