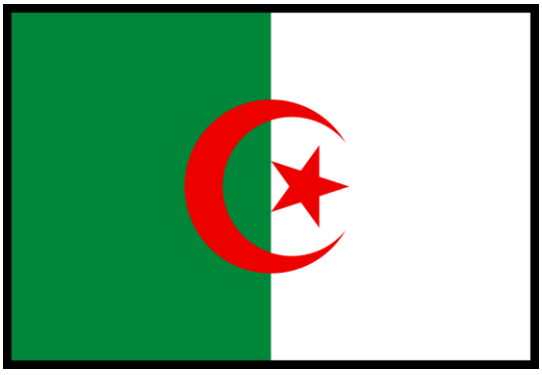
Contents, Sample Pages, List of Figures, List of Tables only

This is the Eleventh Edition of our report on Algeria's Oil and Gas Industry. It contains 373 pages and includes data on over 65 developed and undeveloped fields.



Algeria
Oil and Gas Industry
Strategic Report

By

BAYPHASE DATA

Eleventh Edition
September 2021

Produced By

Our Product Clients



Introduction

This Report presents Algeria's oil and gas potential and is a must for anyone interested in engaging in Algeria's oil and gas sector exploration, investment and research.

Algeria's vibrant oil and gas sector, its proximity to Europe make this report a must to purchase not just for professionals interested in Algeria's oil and gas industry but also for those interested in its strategic impact on hydrocarbon supplies globally. In addition, Algeria's high quality crude oil and its significant gas reserves make this Report a reference point for new and existing investors wanting to acquire assets or engage in the country's oil and gas exploration and development.

This Report, the **Eleventh Edition,** provides a comprehensive review of Algeria's Oil and Gas Industry, including these elements:

- **Upstream:** Fields and Production Facilities
- **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 Algeria's upstream oil and gas fields and their production facilities. Here a basin-wise view of Algeria has been taken with the country categorized in to its four main sedimentary basins:

- Trias/Ghadames (Berkine)
- Illizzi
- Grand Erg/Ahnet
- Reggane

The main focus of work undertaken for this revision are detailed breakdowns of Algeria's historic hydrocarbon production both on a country-wise and field-by-field basis, these breakdowns include:

- Liquids Production
    - Oil
    - Lease Condensate
    - LPG
    - NGL
- Natural Gas Production
    - Marketed
    - Re-Injected
    - Flared

The Report provides analysis and enhanced data sets on some **65 oil and gas fields**; some currently in production - others undeveloped awaiting investment. This also includes historical production updates and figures for each of fields in Algeria over the period 2003-2020.

On a country-wise basis the Report includes production figures over the period 1959-2020.

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.

From an **Oil Reserves** perspective, the report charts Algeria's proven reserves of about 19.24 Billion barrels.

From a **Gas Reserves** perspective the report charts Algeria's proven reserves of 86.84 Trillion Standard Cubic Feet

From an **Investment Perspective** the report shows how between 74 and 116 Billion Dollars of investment will be required by Algeria's oil and gas industry over the next 10 years to unlock its production potential.

Report History:

- 10th Edition May 2015 – 339 pages
- 9th Edition October 2014-319 pages
- 8th Edition April 2013-339 pages
- 7th Edition November 2011 -339 pages
- 6th Edition October 2010 - 334 pages
- 5th Edition January 2010 - 334 pages
- 4th Edition June 2009 - 326 pages
- 3rd Edition July 2008 - 316 pages
- 2nd Edition October 2005 - 326 pages
- 1st Edition November 2003 - 234 pages

What You Get:

- Editable, extractable and printable copy of the current Report
- Hard copy version of the current Report
- For 12 months following purchase you will be supplied with any updates made to the Report.

Field Analysis Sample

The analysis carried out on each of the 65 fields is illustrated by the sample provided below:

Hassi R' Mel

Hassi R'Mel (Desert Gate) is Algeria's first and largest wet gas field, located 550 km south of Algiers covering an area of over 3,500 km^2.

Algeria's largest gas field was the subject of a major production enhancement program. 3 gas compression centres with a total capacity of 9,850 Million standard cubic feet per day were completed in 2004. Commitment to significant further expenditure is yet to be made.

Key Field Data

The Hassi R'Mel gas-condensate reservoir is a large elliptical anticline structure with a South-West/North-East orientation. The produced gas comes from three different Triassic sand levels (A-B-C) between 7,026 feet and 7,593 feet.

- Layer A occurs throughout the field and is composed of fine sandstone with strong anhydritic cementing. Its height ranges from 43 feet – 113 feet and average porosity is 15% while permeability is 260 millidarcy. Average water saturation is 18.5%.
- Layer B is more restricted, wedging out on the southern and eastern flanks. Its composed of shaly fine sandstone intercalate in a series of shale. It ranges from 0 feet – 100 feet in thickness, porosity is 15% and average permeability drops from over 500 millidarcy in the channel axes to 0.1 millidarcy on the edges. Average water saturation here is 20.48%.
- Layer C, also restricted, is composed of fine and medium sandstone with many conglomerates. With a thickness ranging from over 0 feet in the Southern zone to 200 feet in the Northern zone this is the thickest of the three layers. It has excellent petrophysical characteristics with average porosity of 16.8% and permeability of 641 millidarcy. Average water saturation is 16.5%.

The composition of gas at Hassi R'Mel is; C_1: 78.6%, C_2: 7.3%, C_3: 2.7%, C_{7+}: 2.3%, N_2: 5.3%.

Hassi R'Mel had original reserves of some 85 Trillion standard cubic feet and the first of 5 production units were brought on production in 1974.

Key data for this field is provided in Table 1.

Table 1: Hassi R'Mel Key Field Data

Parameter			**Value**	
Discovery Date			1956	
On-stream Date			January 1974	
Reserves	Original	Gas (Billion Standard Cubic Feet)	85,000	
		Condensate (Million Barrels)	3,300	
	Remaining	Gas (Billion Standard Cubic Feet)	13,775	
		Condensate (Million Barrels)	1,159	
Production	Current	Gas (Million Standard Cubic Feet Per Day)	9,641	
		Condensate (Barrels Per Day)	144,615	
	Potential	Gas (Million Standard Cubic Feet Per Day)	9,850	
		Condensate (Barrels Per Day)	210,000	
Geology	Producing Horizon(s)		Triassic (A-B-C)	
	Rock Type(s)		Sandstones	
	Reservoir Depth (feet)		7,026 – 7,593	
	Gross Rock Volume (Million Cubic Feet)			
	Reservoir Thickness (Feet)		45 - 415	
	Porosity (%)		15 – 16.8	
Fluid Properties	Oil	Gravity (^{o}API)		
		Sulphur Content (wt %)		
	Gas	Condensate Gas Ratio (Barrels/ Million Std. Cubic Feet)	15 (estimate)	
		Hydrogen Sulphide Content (mol %)		
		Carbon Dioxide Content (mol %)		
		Molecular Weight		
Existing Facilities	Subsurface	Number of Producers	Now 160	Plan -
		Number of Gas Injectors	Now 54	Plan -
	Surface	Separation Capacity (barrels per day)	200,000	
		Compression Capacity (MMscfd)	2,900	
		Acid Gas Treatment capacity (MMscfd)	-	
		Gas dehydration capacity (MMscfd)	9,850	

Hassi R'Mel has Algeria's largest gas production and processing complex. It also acts a hub for the gathering and onward export of gas from other fields across the country. This is a role that is set to expand as a number of significant gas projects are brought on stream.

Hassi R'Mel started production in 1961 with two gas processing units producing up to 45.9 billion cubic feet per year of wet gas. In 1969, another four installed units increased capacity to 141 billion cubic feet per year. From 1972 to 1974, six additional units were brought on stream raising production to 494 billion cubic feet per year, enabling the field to supply feedstock to the Skikda liquefaction plant. In 1974, 21 production wells were in operation at Hassi R'Mel.

Stimulated by the significance of the recoverable reserves of gas, condensate and LPG in the field, and the prospects for growing gas demand in Europe, Sonatrach implemented plans to further develop the fields output. However, over the period 1961 to 1979, the yield of gas liquids had decreased from 44 barrels per million standard cubic feet of dry gas (in 1961) to 40.9 barrels per million standard cubic feet of dry gas (in 1979) and it became necessary to maximize the LPG and condensate recovery by partial cycling of the dry gas.

From 1980 to 1986, while the gas liquids yield continued to drop from 40 barrels to 28 barrels per million standard cubic feet of dry gas, a major development plan was completed in October 1980, the purpose of which was to establish alternate production and reinjection zones to boost pressure in the field. The scheme involved re-injecting part of the gas produced into the reservoir at high pressure through two 1.059 trillion standard cubic feet per year compressor stations. Two lines of injectors (one line between northern and central producing areas and the other between the southern and central producing areas) were installed.

All gas production and injection modules were to operate at capacity until the plant inlet pressure of 1,422 pound per square inch (psi) limited gas production. Over the period wet gas production was boosted from 812 billion standard cubic feet per year to 3,461 billion standard cubic feet per year with additional processing facilities and an LPG recovery complex, raising Hassi R'Mel's total LPG production capacity to 28 million barrels per year, was commissioned.

Over these 15 years, more than 48.5 trillion standard cubic feet of wet gas, 1.59 billion barrels of condensates and 326 million barrels of LPG were produced from 160 wells, and 22 trillion standard cubic feet of gas was injected into the reservoir via 54 injectors.

Since 1997, Hassi R'Mel has been producing more than 3,532 billion standard cubic feet per year of wet gas at its maximum capacity. The cycling rate has decreased dramatically from 38% (in 1997) to 21% (in 1999), causing the yield of liquids per million standard cubic feet of dry gas drop from 27 barrels to 21 barrels. Liquids recovery has fallen to a level close to the minimum rate of operation required for the gas processing facilities. In addition, the pressure drop impacted the influx of the aquifer and some wells located on top of the structure in the southern part of the field, had to be shut-in due to high salinity.

The main production facilities were constructed at the field in the late seventies. 5 plants were built and all were on stream by 1979. These were of a simple design including separators and relying on Joule-Thompson plants to achieve separation of associated natural gas liquids. The names, locations and capacities of these plants are summarised in Table 2.

Table 2: Existing Plant Capacities at Hassi R'Mel			
Name	**Location**	**Capacity (MMscfd)**	**Type**
Module 0	Central	1,900	Separation, J-T
Module I	Central	2,600	Separation, J-T
Module II	South	2,200	Separation, J-T
Module III	North	2,200	Separation, J-T
Module IV	Central	950	Separation, J-T

Modules II, III and IV were installed by JGC.

Given the length of time of production at the field – over 20 years – Hassi R'Mel has begun to deplete and is experiencing reduced well head pressures. The constraints of the surface facilities imply a minimum pressure value of 1,636 pounds per square inch (psi) at the well head. The lower pressure in the reservoir results in lower wellhead pressure and insufficient energy to move the gas until its treatment into the different modules, necessitating gas compression to be installed.

Various simulations on the sales gas profile showed that the compression was required by 2003. Sonatrach accordingly had three major gas boosting compressor stations and 11 compression lines installed at the field in late 2003, which were designed to boost production from the well heads and to maintain design throughputs through the existing separation and treatment plants.

Compressor stations were installed at three sites:

- **North:** capacity will be 2,200 Million standard cubic feet per day and this unit will deliver gas to module III.
- **South:** capacity will be 2,200 Million standard cubic feet per day and this unit will deliver gas to module II.
- **Central:** capacity will be 5,450 Million standard cubic feet per day and this unit will deliver gas to modules 0, I and IV.

JGC implemented the installation contract for this project. The contract was awarded in May 2001.

The second phase in compression installations was completed in 2007, adding another six compression lines to the enhanced recovery system. This will maintain pressure at a level allowing maximum recovery of condensates and LPG and will extend Hassi R'Mel production life to 2020, keeping its maximum capacity of 3,532 billion standard cubic feet per year.

With regards to the marketing of Hassi R'Mel's produced gas, nine lines have been built over the years to transport the dry gas, while four others transport condensate and LPG. The majority of the dry gas transportation capacity is dedicated to exports with some of the lines supplying the domestic market.

Since the seventies, Hassi R'Mel gas has been transported to the Mediterranean coastal ports of Arzew (to the north-west) and Skikda (to the north-east), for exports as LNG to the United States and Europe.

Table 3: Gas and Condensate/LPG Transport Pipelines from Hassi R'Mel			
Pipeline	**Length (km)**	**Diameter (in)**	**Comments**
Hassi R'Mel – Arzew (GZ0, GZ1, GZ2, GZ3 & LZ1)	507 – 509 (each line)	24 – 20 (GZ0) 40 (GZ1, GZ2) 42 (GZ3) 24 (LZ1)	Main gas pipelines from Hassi R'Mel to LNG plants.
Hassi R'Mel – Skikda (GK1, GK2)	573	40 (GK1) 42 (GK2)	
Alrar – Hassi R'Mel (GR1, GR2)	956, 962	42 and 46	From Alrar gas fields to Hassi R'Mel.

In the eighties, Hassi R'Mel started supplying feedstock for a gas export line to Italy, with the Enrico Mattei pipeline, built across Tunisia and Sicily. This pipeline has an export capacity of 954 billion standard cubic feet per year.

In 1996, Algeria started operating its second export pipeline to Continental Europe. The Pedro Dan Farell was built across Morocco and the strait of Gibraltar to supply Spain and now has a transportation capacity of 388 billion standard cubic feet per year.

In 2019, Hassi R'Mel produced about 3,530 billion cubic feet of gas per year (about 9,641MMscfd); this production is about 60 percent of Algeria's total dry gas production.

Based on our in-country research, data gathering processes and review and cross-correlation of field reports and literature is the field's production history from the years 2003-2020. This is presented in the table below on the average daily production figures. This table has been compiled on a best-effort basis.

Table 4: Hassi R'Mel's Average Daily Production History						
Year	**Average Daily Gas Production** (MMscf/d)	**Average Daily Gas Marketed**[1] (Million Cubic Feet per day)	**Average Daily Gas Injected**[2] (Million Cubic Feet per day)	**Average Daily Condensate Produced**[3] (Barrels per day)	**Average Daily LPG Produced**[4] (Barrels per day)	**Average Daily NGL Produced**[5] (Barrels per day)
2003	13,635	8,181	5,454	122,715	327,240	204,525
2004	13,238	7,943	5,295	119,142	317,712	198,570
2005	12,852	7,711	5,141	115,668	308,448	192,780
2006	12,478	7,487	4,991	112,302	299,472	187,170
2007	12,114	7,268	4,846	109,026	290,736	181,710
2008	11,761	7,057	4,704	105,849	282,264	176,415
2009	11,419	6,851	4,568	102,771	274,056	171,285
2010	11,086	6,652	4,434	99,774	266,064	166,290
2011	10,763	6,458	4,305	96,867	258,312	161,445
2012	10,450	6,270	4,180	94,050	250,800	156,750

[1] The majority of Gas produced, 60%, is marketed, with approximately 10% per annum used In-house and flared.
[2] The majority of Gas produced, 40%, is Re-Injected.
[3] Based on our best estimate, Condensate Gas Ratio of 15bbls/MMscf is considered.
[4] Based on our best estimate, LPG Gas Ratio of 9bbls/MMscf is considered.
[5] Based on our best estimate, NGL Gas Ratio of 24bbls/MMscf is considered, NGL is the sum of Condensate and LPG.

Table 4: Hassi R'Mel's Average Daily Production History						
Year	**Average Daily Gas Production** (MMscf/d)	**Average Daily Gas Marketed**[1] (Million Cubic Feet per day)	**Average Daily Gas Injected**[2] (Million Cubic Feet per day)	**Average Daily Condensate Produced**[3] (Barrels per day)	**Average Daily LPG Produced**[4] (Barrels per day)	**Average Daily NGL Produced**[5] (Barrels per day)
2013	10,146	6,088	4,058	91,314	243,504	152,190
2014	9,850	5,910	3,940	88,650	236,400	147,750
2015	9,750	5,850	3,900	87,750	234,000	146,250
2016	9,700	5,820	3,880	87,300	232,800	145,500
2017	9,680	5,808	3,872	87,120	232,320	145,200
2018	9,740	5,844	3,896	87,660	233,760	146,100
2019	9,641	5,785	3,856	86,769	231,384	144,615
2020	9,641	5,785	3,856	86,769	231,384	144,615

Commercial Data

Sonatrach is the operator of the field and carries 100% of the field equity on behalf of the state.

Investment Opportunity

As far as we are aware at this time there are no expansion or remediation projects planned.

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