

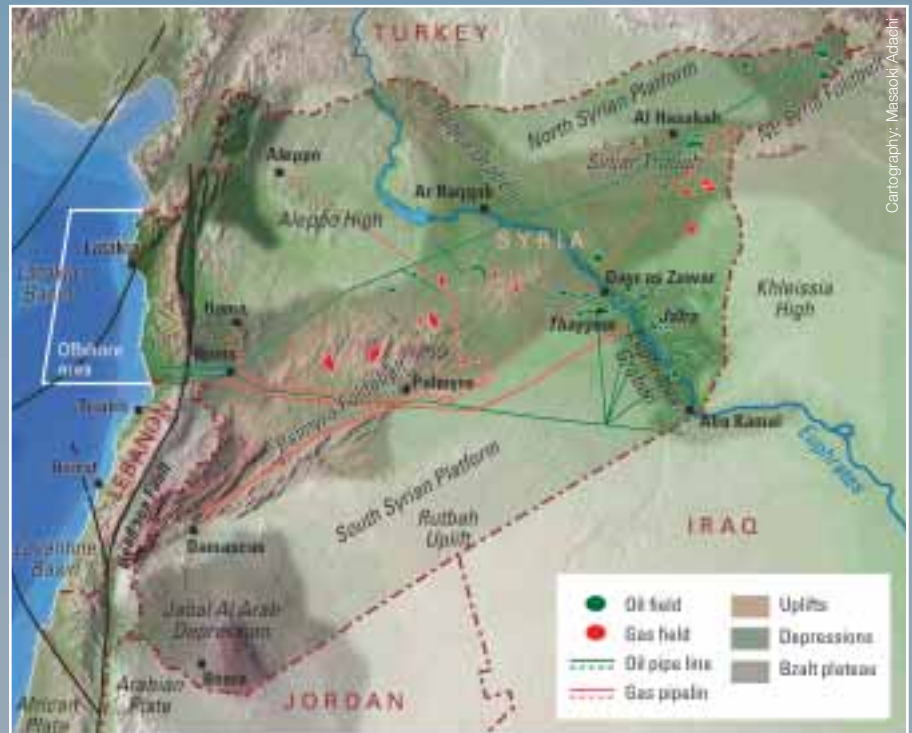
# Encouraging Exploration

In the barren landscape of the Syrian desert you may find an occasional drilling rig exploring for hydrocarbons. In the years to come several more rigs are expected to enter, as the Syrian authorities are now actively encouraging international oil companies to acquire acreage and drill for oil and gas. The next frontier, however, is the offshore, where no wells have yet been sunk.



Photo: Halldan Carstens

Altogether close to 300 exploration, appraisal and development wells have been drilled onshore Syria. The Syrian Petroleum Company has drilled more than half of them.



Oil and gas exploration and production has hitherto been concentrated within three geological provinces: The Palmyra Foldbelt northeast of Damascus, the Euphrates Graben along the river Euphrates, and the Sinjar area, including the Sinjar Trough and the Syria Foldbelt, close to both Iraq and Turkey in the northeastern part of the country. The Euphrates Graben is the main producing area. The coastal basins cover approximately 8,500 km<sup>2</sup>. The geology of the sedimentary basins is poorly known as the very first commercial seismic survey was acquired in 2005 ([www.inseis.com](http://www.inseis.com)).



#### Facts about

### Syria Arab Republic

Area: 185,000 km<sup>2</sup>  
 Coastline: 193 km  
 Population: 19,000,000  
 Independence: 17 April 1946  
 GDP – per capita: USD 3,400  
 Source: The World Factbook

To date, exploration and production of hydrocarbons have taken place only in the onshore sedimentary basins. While exploration was previously largely concentrated to the deep sedimentary basins, new search for hydrocarbons has now also moved onto the platforms. The Syrian Petroleum Company is currently evaluating bids from last year's blocks offering and is now in the process of negotiating several contracts. However, approximately 65,000 km<sup>2</sup> is still open for licensing onshore. It was only last year that the first move towards exploring the offshore acreage was made when InSeis acquired 5000km of 2D data. Following this, an offshore licensing round is expected to be announced late this year.

Halldan Carstens

As an oil- and gas-producing nation, Syria is certainly dwarfed by its neighbours to the east and south, including Iraq, Iran and Saudi Arabia. Nevertheless, Syria has a healthy oil production of some 500,000 bopd and gas production is steadily on the rise to meet domestic demands.

With a soaring population that is approaching 20 million people, Syria has a need to boost the production and increase the oil and gas reserves. The authorities are therefore now actively encouraging international oil companies to explore onshore. Onshore licensing rounds are being arranged with regular intervals with basic information easily available on the home page of the Syrian Petroleum Company (SPC): [www.spc-sy.com](http://www.spc-sy.com).

A recently acquired seismic survey lays the corner-stone for offshore licensing. For the first time, exploration is thus moving offshore this year. The plan is to announce an offshore licensing round at the end of the year. This will open up an entirely new geological province to the oil industry.

## The quest for oil

"We are eager to attract the international oil companies to carry out exploration, and this is why we are now inviting the industry to bid for acreage in licensing rounds that include blocks all over the country," says Deputy General Director and Technical Manager of SPC, Mr Omar Al-Hamad.

"This is the reason why we have made it much simpler to operate in Syria," he says. "There is no need to have an agent. More-

over, there is no requirement for upfront payments, and the system is now totally transparent," he emphasizes. This change in attitude seems to be favourable, as SPC has lately said that the latest exploration round was very successful. Altogether 13 companies made 23 bids for 9 blocks on offer. Companies from Asia, Europe, Middle East and the Americas were bidding.

The authorities are very concerned that the companies that enter Syria have the right qualifications. This is why they have adopted a system of pre-qualification. "The oil companies need to prove that they have the technical expertise. It is by no means sufficient to have the right money to invest," Al-Hamad says.

"Overall, the conditions for the international players are much better now than they use to be," he adds.

## Onshore geology

Syria is part of the northern Arabian Platform that has been proximal to active plate boundaries during most of the Phanerozoic (see page 12 for Geological Time Scale). Active transform and convergent plate boundaries still surround the country, and Syria is close to the collision zone where the Arabian Plate runs into the Eurasian Plate with a speed of almost two cm per year. The convergent movements are accommodated in the Zagros fold and thrust belt in Iran and Iraq, resulting in significant shortening.

The Arabian Plate is bounded to the west and separated from the African Plate by the Dead Sea Fault System. The fault accommodates the differential northward movement between the plates caused by the opening of the Red Sea further south.



Photo: Halldan Carstens

"Gas is now equally important as oil, partly because it is being used to replace oil in power generation" says Mr Omar Al-Hamad, Deputy General Director of SPC. "That is why we need to find more gas," he says.

The offshore acreage thus belongs to the African Plate.

Within this tectonic framework Syria can be divided into three tectonic zones (compare map on previous page): The Palmyride area, the Euphrates Fault System and the Sinjar area in northeast Syria.

The Palmyride is a Late Paleozoic/Mesozoic depocentre trending northeast across central Syria where the present topography is created by compression in the Tertiary.

The northwest-trending Euphrates Fault System, including the Euphrates Graben and the Raqqa Graben, extends fully across Syria from the Turkish border in the northwest to the Iraqi border in the southeast. It is an aborted intracontinental rift of Late Cretaceous age that has subsequently been hidden by Cenozoic burial. Approximately 100 km wide, the system comprises an extensive network of grabens and half grabens extending some 160 km. The graben is relatively unexpressed topographically because of little tectonic reactivation in the Tertiary. The Euphrates depression is a Neogenic depression, and this is also why the river Euphrates follows the graben. Proven recoverable reserves in the Euphrates area are estimated at well over 2 billion barrels of light, sweet oil.

The Abd el Aziz/Sinjar area (including the Sinjar Trough and the Sinjar Foldbelt) is an anticlinorium controlled mainly by a



Photo: Halldan Carstens

Miocene to recent black basalts cover a huge depression with more than 5,000m of sediments in southwestern Syria and northern Jordan (compare map on page 17). This basalt has been used extensively as building stones in the past and is found in ruins far to the north of Damascus.



The river Euphrates provide water for agriculture in southeast Syria. Within the same area and in the same depression some of Syria's largest oil fields are found, including Thayyem.

major south-dipping reverse fault. It is thought that the Abd el Aziz was a sedimentary basin in the Mesozoic which inverted in the Neogene, and may have been the northwestern edge of the larger Sinjar trough which existed at that time. South of Abd el Aziz, and to the north of the Euphrates, is a series of structural highs, controlled by deeply penetrating faults.

In addition to these tectonic zones, there are several stable platforms: the North Syrian Platform, the South Syrian Platform and the Aleppo High. Another important feature is the Jabal Al Arab depression that is covered by extensive basalts (the Drouz Basalt Plateau). Two dry wells have been drilled in this basin.

### **Dwindling oil reserves – increased gas production**

The Syrian oil production peaked in 1995 with 635,000 bopd. Since then it has fallen steadily, albeit not dramatic, and in 2004 the average production was 536,000 bopd, down approximately 5% from the year before, according to the BP Statistical Review of World Energy. In comparison, Saudi Arabia, the world's leading oil producer, produced more than ten million bopd in 2004, while Yemen and Oman produced 429,000 and 785,000 bopd, respectively.

The reason for the decline is probably related to dwindling reserves of Euphrates

fields that began producing in the 1980's. Technological challenges that have not yet been overcome may also be to blame. While the production decreases, the consumption increases, partly due to the population growth that is now about 2.3%. This may cause Syria to become a net oil importer in the foreseeable future.

The main producing oil company in Syria is Al Furat Petroleum Co. (AFPC) with a production of approximately 280,000 bopd (al-Furat meaning the Euphrates). AFPC is a joint venture between the Syrian Petroleum Company (SPC), Shell and Petro-canada that started operating in 1985.

AFPC's main asset is the Thayyem oil field, which was the first field discovered in the Euphrates play in 1985, and remains one of the most prolific fields. Primary production is from the Lower Cretaceous Rutba sandstones, the most prolific reservoir in the graben, charged by Upper Cretaceous source rocks, with additional reserves in Miocene carbonates.

SPC ranks second as an oil producer in Syria with Total in the third place. SPC's operated fields include Karatchuk, which is Syria's first discovery.

The BP estimate of the recoverable proven reserves of oil in Syria is 3.2 billion barrels (509 million m<sup>3</sup>), which is less than half a percent of the total Middle East reserves. This gives a R/P ratio (reserves/production) of only 16 years, meaning that it is important for Syria to find additional reserves.



Photo: Halldan Carstens

Adnan Al-Asmi, exploration manager of SPC.



Photo: Halldan Carstens

Associated gas is now being pumped from the Deir ez-Zour region to western Syria through a 450km pipeline buried in the desert. The gas was previously flared, but following the completion of a gas gathering system and a major gas processing plant, it is now being used for production of electricity.

Gas reserves are also small compared with other Middle East countries, only 0.37 trillion m<sup>3</sup> (13.1 Tcf).

Undiscovered resources are estimated by USGS in a 2000 study. In their study it is concluded that the Syrian onshore basins may contain an additional 1.2 billion barrels of oil, 4.8 Tcf of gas and 313 million barrels of natural gas liquids.

As for gas, Syria in 2004 produced 5.2 billion m<sup>3</sup> or 14 million m<sup>3</sup> per day, which is the highest production rate ever, and it has tripled in ten years.

Syria plans to increase gas production as part of a strategy to substitute natural gas for oil in power generation in order to free up as much oil as possible for export.

### Exploration efforts

"Syrian authorities are determined to boost both production and reserves and reverse the decline in oil production. The only means of doing this is by intensifying the exploration efforts and undertake improved oil recovery projects," says Adnan Al-Asmi, Exploration Manager of SPC.

"These efforts include the licensing of new blocks onshore in several sedimentary basins and an offshore licensing round that is expected late this year or early next year."

"More than 800 structures have been identified to date, almost half of them has been tested by the drill-bit and between 150-200 discoveries have been made," Adnan Al-Asmi adds.

Syria has therefore opened up new blocks for oil and gas exploration. The first round closed in 2001 on five areas. A second round closed in 2002 that involved eleven blocks. A third, also including eleven blocks, was announced late 2002.

"We have two other major projects ongoing. One is to boost production by Enhanced Oil Recovery. Chinese CNPC and Canadian companies are carrying out this. Also, we are looking into developing tar sands, but there is a need to develop new technology," Adnan Al-Asmi says.

### Improving terms

Syria, along with many other countries with an oil industry, is eager to find more oil and gas and boost production by inviting new companies to take part in the boom and applying new technology. The authorities have therefore eased the terms and claim that it is now much easier to operate than it used to be.

## Al Jafra/Tabyyeh oil field

The Jafra oil field is located very close to Dayr as Zawar along the Euphrates and is not very distant from Iraq. The field is operated by a joint venture between SPC and Total E&P Syrie, Dayr es Zawar Petroleum Company (DEZPC). The field was discovered in the late 1980's and started producing in 1991.

There are a total of eight fields in the area, and the combined production is now 35,000 bopd, down from 60,000 bopd when the field was opened. The fields originally had 600 million bbls of oil *in place*. Roughly 80% of the reserves have been produced, thereby demonstrating the need to discover additional reserves to maintain the production level.

Drilling rig working on the Tabieyh field, approximately 15km away from the city of Jafra.



"DEZPC is using low toxic oil based mud, which is very expensive and increases the well cost with 3 million dollars for 10-12 wells," explains drilling supervisor John Williams.



Geologist Mahmoud Al Bittar studying his own account of the lithology.