New Oil and Gas Discoveries

During the period 1999-2003, new oil and gas fields generated additional reserves of nearly 11 000 bcm of natural gas and 62 Gbbl of oil and condensates, volumes very much superior to those discovered in the five previous years. Two-thirds of these discoveries were located offshore, half in deepwater.

At a time when oil prices are soaring to all-time highs and controversy is raging over the date at which oil production will hit its peak — imminent for some, remote for others — it seems opportune to take a look at the reserve replacement situation and the results obtained in the exploration sector.

In recent years, to what extent have world reserves been replaced, and to what extent by new discoveries? Where have new discoveries been made and by whom?

In an attempt to answer these questions, we will examine world exploration results for the period 1999-2003.

The Mechanisms of Reserve Replacement

Two mechanisms are involved in adding to and replacing reserves: the discovery of new fields and the reappraisal of known fields. The latter currently accounts for the main of reserve replacement and increases.

Reappraisal includes discovery of extensions or satellites as well as reevaluation due to a better knowledge of the reservoir acquired during the field development or production, to changes in the economic environment or to technical progress.

Thus far, both mechanisms have been instrumental to the increase of world hydrocarbon reserves: in the last ten years, oil and condensate reserves have grown by between 15 and 25%, depending on the source; the sources citing the highest rates of increase include accumulations of non-conventional crude(1) (see Figure 1). At the same time, natural gas reserves have risen by about 25% (see Figure 2).

The Share of New Discoveries in the Replacement of Hydrocarbon Reserves(2)

New field discoveries have not fully compensated for the volumes of oil produced and consumed since the early 1980s.

Between 1999 and 2003, new discoveries of oil and condensates represented about 62 Gbbl(3). In other words, they only replaced 46% of production during this 5-year period. Two-thirds of these finds were located offshore. For

(1) The *Oil and Gas Journal* includes some of Canada's tar sands in its reserves.
(2) Oil and condensates.
(3) Gbbl: billions of barrels.

Fig. 1 Variations in liquid hydrocarbon reserves according to different sources

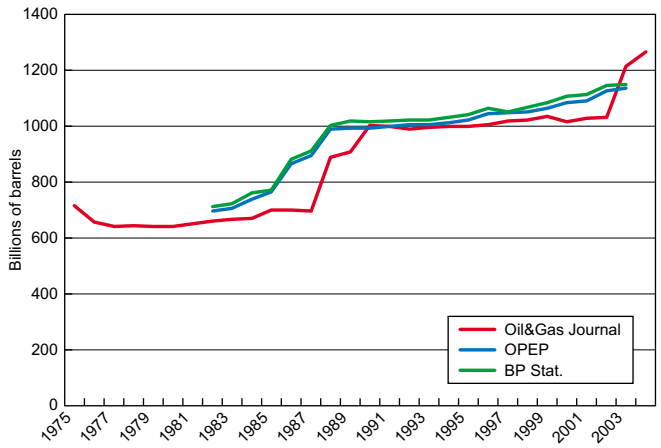
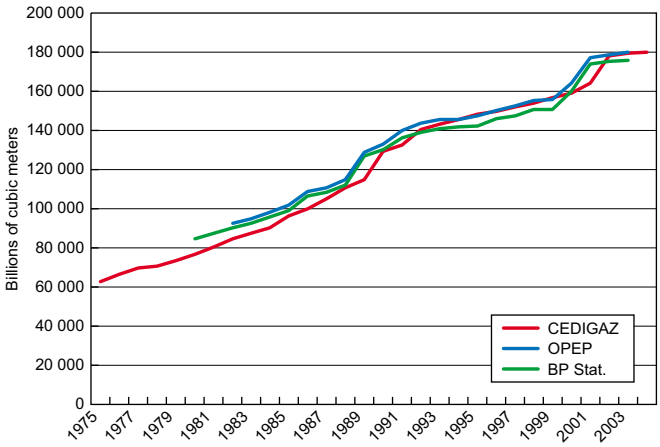


Fig. 2 Variations in natural gas reserves according to different sources



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the same period, new field reserves were substantially superior to those reported for 1994-1998 (an estimated 38 Gbbl), although exploration activity had not really been intensified. The number of exploration wells drilled (new-field wildcats[4] as well as appraisal and delineation boreholes) remained stable worldwide (excluding North America). Actually, the number of new-field wildcats was down (–20%) in 1999-2003 over the previous period.

Exploration success in 1999-2003 was not equally distributed geographically (see Figure 3).

In Africa, new accumulations, four-fifths of which were located in deepwater zones of the Gulf of Guinea, replaced nearly 90% of the reserves produced during the five years under scrutiny.

In CIS countries, new fields achieved reserve replacement of 80%. The giant Kashagan Field (10 Gbbl), discovered in 2000 in the Caspian Sea, accounted for nearly all of these new reserves.

The Asia Pacific reported one of the highest regional rates of renewal by new discoveries (about 70%). Exploration on Chinese territory yielded over one-third of the volumes found in this geographical area.

In other parts of the world — Europe, South America, North America and the Middle East — new fields replaced no more than 40% of production. Europe, a mature region that has entered into decline, only reported a rate of 20%.

Reappraisals of known fields represent the main part of reserve replacement and additions.

(4) New-field wildcat: exploration well bore in hopes of discovering a new field.

Between 1999 and 2003, reappraisals accounted for the replacement of nearly two-thirds of world production. By revising existing estimates upwards, they added about one hundred billion barrels to the total volume of world liquid hydrocarbon reserves.

The Share of New Discoveries in the Renewal of Gas Reserves

Between 1999 and 2003, new gas discoveries totaled an estimated 11 000 bcm, replacing 80% of world consumption during the period.

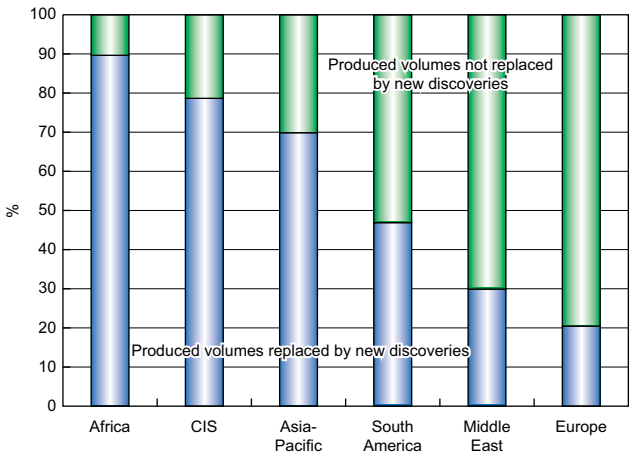
For natural gas, like liquid hydrocarbons, the volumes discovered during this period were larger than in the five previous years (1994-1998). In fact, they were nearly twice as large.

Over half of these discoveries were made in six countries: Australia, China, Indonesia, Azerbaidjan, Bolivia and Egypt. The Asia Pacific region contained 40% of the total volume of new gas discoveries (11 000 bcm).

The reserve replacement rate for natural gas varied substantially from region to region (see Figure 4). In Asia-Pacific, Latin America, the Middle East and Africa, the new discoveries made between 1999 and 2003 fully covered production during these 5 years. The top rate attained among these regions was over 250%.

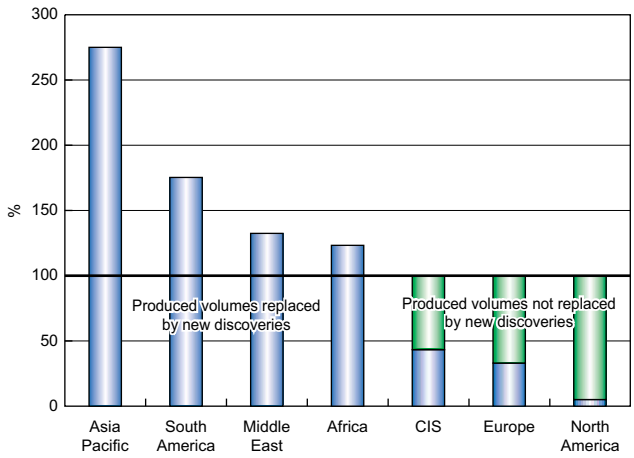
In other regions, however, including the CIS countries, Europe and North America, renewal did not cover production. In North America, for instance, the replacement of volumes produced by new discoveries was virtually non-existent.

Fig. 3 Percentage of oil reserves replaced by new discoveries, 1999-2003



Source: IFP

Fig. 4 Percentage of gas reserves replaced by new discoveries, 1999-2003



Source: IFP

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The reappraisal of reserves discovered before 1999 also helped compensate for the volumes produced and to raise the level of world reserves.

Natural gas reserves discovered before 1999 were reappraised and their volume revised upwards to double that of new discoveries.

New Discovered Fields

The Domination of Offshore Fields

For the five-year period under consideration, over 70% of reserves proceeded from new discoveries of oil and condensates located offshore, with half in deepwater zones.

In some regions including Africa, South America and North America, deep offshore discoveries accounted for even more than two-thirds — or three-quarters — of the commercially viable volumes found during the period.

To understand the ever-increasing importance of offshore oil, we might make a comparison. Today, offshore oil represents less than 25% of the world's reserves and less than 30% of its oil and condensate production. For deep offshore oil, the figures do not reach 5% and 3%, respectively.

Most of the new natural gas discoveries are also made offshore. For 1999-2003, 60% of gas discoveries were located offshore, with two-thirds in deepwater. In some regions, like North America, nearly all of them were made offshore.

Consequently, the offshore sector can be expected to attract a growing share of investment to be allocated to the development of production capacity.

Giant and Supergiant Fields

Most of the giant fields (> 500 Mbbl of liquid hydrocarbon reserves) and supergiants (> 5000 Mbbl) that are currently supplying two-thirds of world oil production were discovered over 30 or 40 years ago. The discovery of a giant field is more of a rare occurrence, although it still happens.

Between 1999 and 2003, 14 giant oil fields were found, mostly offshore. They represented nearly 24 Gbbl, or two-thirds of the total volume discovered during this period.

Two were supergiants: Kashagan (10 Gbbl) was discovered in the Caspian Sea in 2000 and Azadegan (5 Gbbl) in Iran in 1999. The latter discovery was only made possible by a seismic survey of very good quality.

For natural gas, the situation is comparable. Over half of the known giant gas fields (> 500 Mboe[5] or 75 bcm in reserves) were discovered in the 1960s or '70s.

In 1999-2003, 23 giant gas fields were found. They contained nearly 4800 bcm, *i.e.* over 40% of the total volume discovered during this five-year period. Half were found offshore, mainly in deepwater.

Privately-Owned Versus State-Owned Companies

Privately-owned oil companies, which currently hold less than 20% of the world's oil reserves and less than 30% of its natural gas reserves, were globally responsible for new finds representing over two-thirds of discovered oil and gas reserves volumes.

The five largest private companies alone — Exxon, Shell, BP, Total and ChevronTexaco — represent 20% of discovered volumes of liquid hydrocarbons and natural gas.

(5) boe: barrel oil equivalent.

Fig. 5 Giant oil fields discovered, 1999-2003

Country	Field	Location	Year of discovery	Reserves in Mbbl
Nigeria	Erha	Deep offshore	1999	500
Nigeria	Akpo	Deep offshore	2000	590
Nigeria	Bonga Southwest	Deep offshore	2001	500
Kazakhstan	Kashagan	Offshore	2000	10 000
China	Penglai 19-3	Offshore	1999	800
Malaysia	Kikeh 1	Deep offshore	2002	530
Brazil	Jubarte	Deep offshore	2001	539
Brazil	Cachalote	Deep offshore	2002	800
Brazil	1-ESS-121	Deep offshore	2003	660
Brazil	1-ESS-130	Deep offshore	2003	628
Brazil	1-ESS-123	Deep offshore	2003	560
Iran	Azadegan	Onshore	1999	5 000
Saudi Arabia	Niban 2	Onshore	1999	1 800
Iran	Kushk 1	Onshore	2001	1 407

Source: IHS

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The state owned companies (*i.e.* the state has an interest of more than 50%), account for slightly over one-third of new oil and gas reserves. But volumes are not evenly distributed between them: three of these concerns — Saudi Aramco (Saudi Arabia), NIOC (Iran) and Petrobras (Brazil) — account for the lion's share of volumes discovered by state-owned firms: 80% for liquid hydrocarbons and 50% for natural gas.

In conclusion, even if new field discoveries cannot fully replace reserves, they continue to represent fairly substantial volumes of oil and natural gas. This being said, the geographical regions possessing the greatest potential for new discoveries remain totally closed to or render access difficult for foreign investors. An other point has to be underline, the fact that technology plays a critical role: most of the new discoveries are located offshore, often in deepwater, and a growing number would not have been possible without increasingly sophisticated seismic tools and methods.

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