The story of oil in the Sultanate of Oman is, in some ways, rather different from that of the other Gulf countries. Commercial discoveries were not made until the early 1960s, and generally the country’s oil fields were found to be smaller, more complex and more difficult to exploit than those of its Gulf neighbors.

However, since the accession of His Majesty Sultan Qaboos bin Said in 1970, Oman has seen many social and economic improvements that are clearly reflected in the country today.
Exploration for oil in Oman started in 1925, when a two-year exploration license for the Dhofar region was granted by Sultan Taimur bin Faisal to the D’Arcy Exploration Company, whose founder, William Knox D’Arcy, had been successfully searching for oil in other regions of the Middle East since 1908. In the winter of 1926, a geological field party, which included George Lees and Washington Gray, travelled from Bait al Falaj along the coast to Al Khubarah, across Wadi Hawasina and across the Oman Mountains to Mirbat in Dhofar. The results of this remarkable journey were disappointing and the company allowed its license to lapse.

There was little further activity until 1937, when a concession was awarded to the Iraq Petroleum Company (IPC). There was an option under the agreement to take up 75-year concession for Oman and Dhofar. Exploration and production was to be controlled by Petroleum Development (Oman and Dhofar) Limited, comprising 55% for the equal shareholders Shell, Compagnie Française des Pétroles and the Near East Development Company. The remaining 5% was held by Partex, a firm controlled by Gulbenkian.

IPC carried out many surveys, both in coastal regions and in the interior, until fieldwork was halted at the outbreak of World War II. Nevertheless, in 1944 IPC converted its 75-year option into a full concession. However, the Dhofar concession was fraught with difficulties and was relinquished in 1951, when the concession was awarded to Shell and Partex there was no drilling, but no-one knew at the time that it had oil.

In 1956, Shell and Partex joined the D’Arcy Exploration Company, whose founder, William Knox D’Arcy, had been searching for oil in other regions of the Middle East since 1908. In the winter of 1926, a geological field party, which included George Lees and Washington Gray, travelled from Bait al Falaj along the coast to Al Khubarah, across Wadi Hawasina and across the Oman Mountains to Mirbat in Dhofar. The results of this remarkable journey were disappointing and the company allowed its license to lapse.

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The Dhofar concession was acquired in 1953 by Dofhor-Cities Service, a joint venture between Cities Service and the Richfield Corporation of California that found oil in 1957, but not in economic quantities. PDO finally spudded its first well at Fahud in 1956 using a rig that had been flown in from Qatar by Royal Air Force transport aircraft. This was stopped dry, but no-one knew at the time that it had missed a huge oil field by just a few hundred meters. In the period 1956 to 1960, exploration wells were also drilled at Ghaba, Haime and Aftar without finding oil in commercial quantities. In 1961, lack of success prompted the departure of all the shareholders except Shell. The company was left with an 85% stake along with Partex and the

conviction that there was oil in Oman. Total returned to PDO in the 1960s, purchasing a 10% interest in 1967. Meanwhile, between 1957 and 1966, around 30 wells had been drilled in the Dhofar region and several other companies either joined or pulled out of the venture, which had also been continuously hampered by civil unrest.

Good news at last

In the PDO concession operated by Shell and Partex there was no drilling, after the withdrawal of the other partners, until 1962, when surveys confirmed the geological structure first identified by gravimetric surveys at Yibal. After another false start with technical problems at well Yibal-1, well Yibal-2 was sunk and soon encountered unexpected natural gas which caused a serious blowout, luckily without human casualties. On resumption of drilling, light crude was found in the Shuaiba formation.

Further encouraging results at Natih in April 1963 caused PDO to re-examine the prospect at Fahud. Well Fahud-2, just 1.5 km from the unfortunate Fahud-1, confirmed that the whole Natih formation was oil-bearing. These successes provided the green light for the construction of an export terminal at Minah al-Fahal on the northern coast, and 276-km pipeline, costing some $70 million was built from Fahud to Minah al-Fahal on the northern coast, with an initial shipment of 543,800 barrels at $1.42 per barrel.

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This added impetus to the exploration effort, Compagnie Française des Pétroles rejoined PDO, and in 1969 the partnership regained the Dhofar concession. During the 1970s, PDO brought more fields into production (Figures 10.1 and 10.2). Discoveries in Central Oman in 1972–73 included Qam Alam, Ghaba North, Saih Nihayda, Habur and Saih Rawl. A sharp jump in oil prices in 1973 prompted a further flurry of exploration, especially in the eastern part of the south Oman salt basin, where discoveries included the Amal and Amin fields.

Figure 10.1: Installation of a culkin pump at a well in Amal in May 1970

The oil and gas fields of Oman

Figure 10.2: Constructing the natural gas pipeline that stretches 200 miles from Yibal gas field to a power plant at Dhofar on the coast in 1977
In 1974, the government took a 25% stake in PDO, subsequently increasing it to 60% and with corresponding reductions in the holdings of Shell to 34%, Total to 4% and Partex to 2%.

The Central Oman oil fields came on-stream during 1975–76, bringing the country’s total production to 280,330 B/D and total proven reserves to some 1.278 billion barrels.

In 1977, the government of Oman and private shareholders signed a new, long-term agreement giving greater incentives for the development of the South Oman oil fields. By 1980, discoveries had been made at Rabah, Birba, Qaharir, Majhur, Rima, Jalimud, Runib, Qta, Dhabanah South, Nimir, Jazal, Zauiljah North East, Sayula, Suwaihat, Karim West, Nimr West, Runib, Qata, Dhabanah South, Nimr, Jazal, Zauiljah North East, Sayula, Suwaihat, Karim West, Nimr West, Wafra, Fayyadh, Amin, Dhubalma, Kaukab, Bahja, J awad, Hashirah, Anzauz, Burhan, Ifsan and Jameel. By 1982, most of these fields were on-stream, bringing production to around 325,000 B/D and putting reserves at 2.98 billion barrels. After a string of further discoveries, the most recent finds include the southern Al-Noor and Al-Shamou fields.

Following PDO’s successes in the 1960s and early 1970s, a number of foreign companies began to develop an interest in Oman. However, a succession of dry wells and noncommercial finds persuading most companies that the bulk of Oman’s oil and gas had been discovered.

Exploration programs have been curtailed in recent years. Despite limited prospects, there are still many foreign companies and consortia in the country. In 1998, there were 12 groups (excluding PDO) chasing Oman’s oil and gas. Oman has yet to produce oil or gas.

Oman has essentially preserved its original concession and participation regime – converting early agreements and more recent exploration contracts into production-sharing deals. PDO accounts for the bulk of Oman’s crude oil exploration and production activity. Its success reflects the fact that the PDO concession encompasses the country’s richest oil provinces. Other companies with fields in production are Occidental (Sunanah), Japex (Wadi Askew) and Novus (Busaha).

The reserves
Oman’s crude oil reserves (Figure 10.3) are estimated at 5.28 billion barrels, with almost 95% being located in the PDO concession area. At the current rate of output of around 900,000 b/d, Oman has a reserve production of around 18 years.

The number of fields that contribute to PDO’s production has risen from 11 in 1967-1980 to almost 100 currently. Together, the Yibal, Niful, Fahud, al-Huwasah and Lekhwair fields are net to account for almost half of the country’s total oil production. Yibal is the largest oil field in Oman, producing around 180,000 b/d. Northern oil, of the type found in Yibal field, is light (32–39° API) and is mostly found together with natural gas. Southern oil fields, such as Nimir and Amal, produce heavier crude (40° API).

PDO is pursuing an active exploration program for both oil and gas and is more than maintaining the level of its reserves. In 1996, it added 327 million barrels of new oil and condensate reserves, a figure that exceeded the volume produced by 23 million barrels. The main addition to reserves came from: Burhan West Deep (Barik) reservoir that contains 8 million barrels of new reserves • Sati Ralif Deep (Barik) reservoir where studies identified an additional 26 million barrels of condensate • Thayfut Ghairi reservoir.

These figures fit the pattern for recent reserves additions where the increases are related to re-evaluation of the potential in producing fields and other known, but unexploited, structures.

The recently discovered Al-Noor and Al-Shamou fields have estimated combined reserves of 348 million barrels. PDO hopes to increase these reserves to 1.8 billion barrels and 2.7 billion barrels by 2003 and 2011 respectively.

The installation of water-injection schemes also remains a high priority for PDO. The company embarked on a major enhanced oil recovery (EOR) research program in 1985, conducting pilot schemes to test different methods of gas, water and steam injection before applying them in the field. The company estimates that the application of EOR techniques could help it extract an additional 1500 million barrels of oil from reservoirs containing heavy, viscous crude oil.

Doubling of gas reserves
According to PDO, Oman’s gas reserves have more than doubled over the five years to 1998. The company put the total in 1998 at 28.32 Tcf - 25.37 Tcf of non-associated gas and 2.95 Tcf of associated gas. Until the mid-1980s, gas in Oman was only discovered as a by-product of oil exploration. In 1984, however, PDO signed a 10-year agreement with the government under which it would start exploring specifically for non-associated gas. The country’s gas reservoirs are almost all contained within the PDO concession and usually occur in deep zones under oil-bearing structures. Some of PDO’s exploratory drilling program is still directed at these difficult targets (see Figure 10.4). The sharp growth in known gas reserves has encouraged the government to make the development of natural gas production a high priority in its overall economic strategy. In addition, it has given rise to a number of projects for exporting natural gas, both by gas line and in liquefied form. Oman became an exporter of liquefied natural gas in April 2000, with its first shipment to Korea. The 6.6 million-tonne-per-year liquefaction plant is located at Qalhat, near Sur.

Exports
Oman exports about 90% of its crude oil, and the volume exported has tracked recent rises in production. In the early 1990s, the government decided to exploit the country’s natural gas resources for the production and export of liquefied natural gas (LNG) and in 1992, asked PDO to undertake a three-year appraisal program to test the production potential of known structures. That called for the drilling of 12 deep wells in the Sati Ralif, Sati Nihayda and Barik fields – the three structures in the center of Oman that would supply the natural gas feedstock for the LNG project. In 1996, PDO and the Korea Gas Corporation (KGC) signed a firm contract for the supply of 4.1 MMt/yr of LNG over a 25-year period starting in 2000. This 1996 deal was the largest single-buyer, LNG contract ever agreed at that time.

The upstream work for this project called for 31 new wells at the Barik and Sati Rawl fields between 1997 and 1999.

Field development technology
The geology of Oman is complicated and presents PDO with a range of problems. For example, there are known reservoirs of light crude that lie at great depth in complex reservoirs. As a result of these challenges, PDO has been at the forefront of applying horizontal well technology to the problem of bypassed oil in geologically complex environments. More than 90% of the wells drilled in Oman are horizontal. PDO has installed an online, real-time, computerized production system that controls the operations of all its fields.

This has increased effective production by 5% and helped to save the company around $7 million per year in operating costs and capital expenditure. Electric instrumentation and software have been installed on over 1200 wells and at associated production facilities. Well data are transmitted in real-time to the central computer that ensures optimal control of the well processes.
The giant Bab oil and gas field. The project added two 350 MMscf/D trains to treat and process associated gas from Bab’s lower Cretaceous Thamama B reservoir and nonassociated gas from the Thamama C reservoir. A 625 MMscf/D train was put in place for nonassociated gas from the Thamama F and compression facilities that could inject up to 830 MMscf/D into this layer.

The second phase of the OGD project increased condensate capacity by 50,000 B/D and added 1.8 Bcf/D of sales gas by 2000. Sustained economic growth and urbanization will ensure a high and growing demand for gas to use in power generation and water desalination. While the established industrial sectors typified by operations at Das Island continue into the next millennium (Figures 16.7 and 16.8) there are new directions for business and industry in the UAE.

Beyond the oil

The United Arab Emirates is a relatively new oil and gas producer with production starting in the 1960s (Figure 16.9) and the country being formally constituted from the seven Emirates in 1971.

The country has used its oil and gas revenues to establish itself as one of the leading business centers in the Middle East. Unable to rely on vast oil reserves for continued growth, Dubai has become a central Middle East hub for trade and finance, accounting for about 70% of the Emirates’ non-oil trade. In 1996, Dubai unveiled its strategic development plan for the twenty-first century, which focused on the private sector and emphasized capital-intensive industries. It called for a new infrastructure and the loosening of trade and banking rules. For its part, Abu Dhabi planned to develop an offshore financial and commodity trade center on Saadiyat Island. This will include storage facilities, a port, a freight center, and a financial and insurance center to facilitate trading.

In recent years, the UAE has undertaken several projects to diversify its economy and to reduce its dependence on oil and gas revenues. According to one Emirates newspaper, the non-oil sector accounted for 69% of the gross domestic product in 1997. The federal government has invested heavily in sectors such as tourism, telecommunications, re-export commerce and aviation. As part of its strategy to further expand its tourism industry, UAE plans to build new hotels, restaurants and shopping centers, and to expand airports and duty-free zones.

Figure 16.8: Das Island tanker terminal. French tanker Saint Remi being moored at the terminal. A head line is being taken on board a work boat.

Figure 16.9: From first oil in the 1960s to fully developed fields in the 1990s, production in the United Arab Emirates has grown rapidly. The economic changes which have accompanied this oil boom have made the UAE a major player in the Middle East oil and gas sector.