
Oil and Gas in the UAE

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Introduction

The prosperity of the United Arab Emirates and its rapid transformation from a backward desert region to one with a booming economy have been made possible by revenue from oil exports. The UAE possesses nearly 10 per cent of the world's total reserves, and there is no doubt that oil will continue to provide the income for both economic growth and the expansion of social services for several more decades at least. In the coming years, natural gas will play an increasingly important role in the UAE's development – particularly as a fuel source for power generation, petrochemicals and manufacturing industry. The UAE has also taken the initiative in developing an intra-Gulf gas network that could eventually link up with the Indian subcontinent.

Early in 2000, the UAE marked the fiftieth anniversary of the drilling of the first oil well at Ra's Sadr, north-east of Abu Dhabi. It was an inauspicious start for the oil industry, because the well proved to be dry. Not for another decade were major discoveries made, although the Trucial States (the areas which became the UAE in 1971 after the British withdrew from the Gulf) swiftly made up for lost time. In a matter of a few decades, Abu Dhabi, supported by Dubai, turned the UAE into one of the major players in the international oil export industry. Proven recoverable oil reserves in 2000 were put at 98.8 billion barrels. At the same time, proven recoverable reserves of natural gas in the UAE were estimated in 2000 at 6 trillion cubic metres, or 4 per cent of the world total. This makes the UAE's gas reserves the third largest in the Middle East (after Iran and Qatar) and the fourth largest in the world (with Russia holding the biggest reserve), although – as will be explained later in the chapter – gas production in Abu Dhabi is never likely to be as economical as in some other Gulf states.

The Development of Abu Dhabi's Oil Industry

By far the biggest deposits of oil in the Emirates have been found in Abu Dhabi. The emirate controls more than 85 per cent of the UAE's oil output capacity and more than 90 per cent of its reserves. As oil exports began in the late 1950s and early 1960s, it was still a largely undeveloped desert emirate inhabited by nomads, pearl divers and fishermen. The ruler's fort was the only building of substance on Abu Dhabi island, the site of the city today. There were

no roads or basic amenities. Expatriate workers from Bahrain or Kuwait – where the petroleum industry was much more advanced – were flown in on small aircraft which landed on runways of flattened sand mixed with oil. In 1966, when Sheikh Zayed bin Sultan Al Nahyan became ruler, there were fewer than 20,000 people living in Abu Dhabi.

At the beginning of the twenty-first century, Abu Dhabi, with a population of around 600,000, boasts a Manhattan-style skyline with high-rise buildings rising out of a city with tree-lined streets, and spacious parks and gardens. It is by far the cleanest and environmentally friendliest city in the region. Against the background of a carefully managed oil and gas industry, the UAE as a whole enjoys a high standard of living with public services and amenities as advanced as any in the world.

While the Emirates were late starters in the oil export business, the idea that there might be oil under their deserts had taken root just before the outbreak of the Second World War in 1939. This was a period of British domination of the Gulf region. Under treaties signed with most of the sheikhdoms, including Abu Dhabi, the British government, through its Political Resident based in Bahrain, had the right to approve or reject the awarding of oil concessions in the Gulf. This was part of Britain's policy of protecting the route to India by making sure that no other foreign power could get a foothold in the region. It is no surprise, therefore, that British companies played a leading role in the development of the oil industry in Abu Dhabi and other Gulf sheikhdoms. A 75-year concession for all the onshore oil rights in Abu Dhabi was awarded to the Petroleum Development Company (Trucial Coast), a subsidiary of the Iraq Petroleum Company (IPC), itself a joint venture of several oil majors, including BP, Shell, Total, Exxon and Mobil. During the Second World War, all exploration work in Abu Dhabi, as in the rest of the Gulf, was put on hold, and after the war, efforts were focused more on Qatar, Bahrain and Kuwait than on Abu Dhabi. In 1953, the D'Arcy Oil Company acquired Abu Dhabi's offshore concession, passing it on two years later to Abu Dhabi Marine Areas (ADMA), owned initially by British Petroleum (BP) and Compagnie Française des Petrole (CFP – which became Total). In 1958, ADMA became the first company to discover oil in commercial quantities – at Umm Shaif close to Das Island. A production and processing centre and an oil export terminal were built on the island. Crude began to be shipped from Das Island in 1962 – the year when Abu Dhabi joined the family of oil exporters and the rapid transformation of the emirate began.

Also in 1958, Petroleum Development (Trucial Coast) discovered the onshore Bab oilfield, following up with the discovery of the Bu Hasa field in 1962. In that year the company changed its name to the Abu Dhabi Petroleum Company (ADPC), agreeing at the same time to give up parts of its concession every two years thereafter.

In its first year of oil production (1962), Abu Dhabi produced 14,200 barrels per day (b/d) of oil. The following year, production rose by a staggering 239.4 per cent to 48,200 b/d and by an even bigger jump (287.6 per cent) to 186,800 b/d in 1964.

ADMA's success continued in 1965 with the discovery of the offshore Zakum oilfield. Exports began two years later. Subsequently ADMA kept only part of the field (Lower Zakum), with the Zakum Development Company (ZADCO) – owned by the Abu Dhabi National Oil Company (ADNOC), 88 per cent and the Japan Oil Development Company (JADOC), 12 per cent – taking over the rest (Upper Zakum). In 1968, a third concessionary company, Abu Dhabi Oil Company (ADOC), was formed. Established by Maruzen Oil Company, Daikyo Oil Company and Nippon

Mining Company, it was awarded a 45-year offshore concession for a 4416 sq. km tract relinquished by ADMA. Oil was struck in September 1969 on the island of Mubarraz. ADOC brought the field on stream in 1973. Today its shareholders are: Cosmo Oil, 51 per cent; Japan National Oil Corporation, 17.8 per cent; other Japanese companies, 5.5 per cent.

After the ending of the Trucial States' treaties with Britain and the creation of the UAE in 1971, the Abu Dhabi National Oil Company (ADNOC) was set up – to manage and operate all aspects of the emirate's oil and gas industry. ADNOC acquired a 25 per cent stake in both ADPC and ADMA. In a further change, BP sold a 45 per cent stake in ADMA to a Japanese consortium, Japan Oil Development Company (JODCO). On 1 January 1973, ADNOC increased its stake in ADPC and ADMA to 60 per cent. Nevertheless, Abu Dhabi was the only Gulf oil producer to retain foreign partners on a production-sharing basis, rather than have the national oil company acquire 100 per cent control of oil operations. Today, oil companies from Japan, France, the United Kingdom, the United States and elsewhere own up to 40 per cent of the energy sector in the emirate. The decision to limit state control of the companies to 60 per cent was taken with a realization on the part of the emirate that its oil industry would benefit from the advances in technology and the depth of expertise which international majors could bring. The decision paid off – giving Abu Dhabi a technological edge over fellow-producers in the Gulf, some of which (notably Kuwait and Saudi Arabia) were realizing, as the new century dawned, that their own industries needed outside expertise to help in developing oil and gas production and in incorporating the latest technology in their industries.

Back in the early 1970s, further adjustments were made to the structure and identity of companies operating in Abu Dhabi followed the government's decision that ADNOC should take 60 per cent stakes in the two major ones. On 2 April 1977, ADMA was renamed the Abu Dhabi Marine Operating Company (ADMA-OPCO) and designated as the emirate's offshore operator. The shareholdings were unchanged: ADNOC (60 per cent); BP (14.66 per cent); Total (13.33 per cent); and JODCO (12 per cent). Offshore production continued steadily over the next two decades, and in 1997, ADMA-OPCO awarded a gas injection project for the Zakum field to enhance oil recovery. The field was already equipped with extensive water injection facilities for pressure maintenance purposes. A new compression platform and injection network was built to deliver the gas to the injection wellheads. The compression platform incorporates three compression trains capable of handling a total of 300 million cubic feet daily (mn cfd). A pipeline system delivers gas to five existing wellheads operated by ADMA-OPCO and ZADCO. The existing wellheads were modified to accommodate the required injection wells and pipeline tie-in facilities, serving both the Upper Zakum and Lower Zakum oil reservoirs. In February 2000, the Japan National Oil Corporation (JNOC) and ADNOC signed a memorandum of understanding to cooperate in research and in raising oil production capacity in the emirate. Abu Dhabi's main offshore oilfields are Umm Shaif, Lower Zakum, Upper Zakum, al-Bunduq and Abu al-Bukhoosh.

On 20 September 1978 the Abu Dhabi Company for Onshore Oil Operations (ADCO) was established to take over onshore operations. The new company's shareholders were: ADNOC (60 per cent); BP (9.5 per cent); Shell (9.5 per cent); Total (9.5 per cent); Exxon (4.75 per cent); Mobil (4.75 per cent); Partex (2 per cent), these foreign companies being the shareholders of ADPC. Abu Dhabi's main onshore oilfields are the fields at Asab, Bab, Bu Hasa, Sahil and Shah. Other fields are under development at Dabb'iyah and Rumaitha.

While ADMA-OPCO and ADCO are the major companies on the Abu Dhabi oil scene (accounting for more than 90 per cent of production), some other companies – besides ADOC – also operate there. The Total Abu al-Bukhoosh Oil Company was formed in 1973 to develop the offshore Abu al-Bukhoosh oilfield, discovered in 1969, which came on stream in June 1974. The original owners of the company were Total (51 per cent), the US's Charter Oil (24.5 per cent), Canada's Sunningdale Oil (12.25 per cent) and Amerada Hess of the US (12.25 per cent). In 1991, Charter Oil sold some of its stake to Total, leaving the latter with a 65.7 per cent stake, and later sold the rest the same way. Sunningdale Oil, meanwhile, sold its shares to Amerada Hess, giving it 25 per cent of the shares, with the remainder owned by Total. In 1996, Amerada Hess sold its shares to Japan Indonesia Petroleum. Production from Abu al-Bukhoosh peaked in 1976 at 81,000 b/d and is currently running between 40,000 b/d and 50,000 b/d.

The Bunduq offshore oilfield was discovered in 1965 in an area that straddles the offshore border between Abu Dhabi and Qatar. The two countries agreed to share equally production from the field, and BP, Total and the United Petroleum Development Company of Japan established the Bunduq Oil Company. Production began in 1975 at 30,000 b/d, but because of reservoir pressure maintenance problems this fell to 10,000 b/d in the late 1970s, and, in October 1979, stopped. In 1981, a secondary recovery programme, costing around US \$400 million, was launched to reactivate the field. Production restarted at 4000 b/d at the end of 1983 and is currently at around 15,000–20,000 b/d.

In 1973, Amerada Hess, leading a consortium of foreign companies (Marathon Oil, Canadian Superior, Syracuse Oil, Wingate Enterprises, Bow Valley and Sunningdale), discovered another offshore oilfield, Arzanah. But in 1993, with production having fallen from a peak of 20,000 b/d in 1980 to around 6000 b/d, Amerada Hess relinquished its concession and operations were taken over by ZADCO. Initially, plans to produce oil from two nearby undeveloped fields, Dalma and Hair Dalma, offered the possibility of maintaining the Arzanah field and the production facilities on Arzanah island. However, further studies showed that this would not be commercially viable, particularly because of the need for investment to reduce emissions harmful to the environment, and so in November 1998, after nearly 20 years of production, a decision was taken to decommission the field.

Abu Dhabi's oil is considered light, with gravities in the 34–40 degree API range (Murban 39 degrees, Lower Zakum 40, Umm Shaif 37 and Upper Zakum 37). Murban, a blend from the onshore fields, is its major export crude, exported from the Jebel Dhanna terminal which was built in 1963 and expanded a decade later. Umm Shaif and Zakum crude is exported from the terminal on Das Island. Smaller amounts of oil are exported from Abu al-Bukhoosh, Mubarraz and Zirku Island. The quality of Abu Dhabi crude, the long-term evergreen contracts with the customers and the security of supply have combined to make the UAE a major supplier of crude oil to the Far East. Abu Dhabi is by far the biggest supplier of crude oil to Japan.

Oil Refining in Abu Dhabi

Since 1999, oil refining in Abu Dhabi has been carried out by a wholly-owned subsidiary of ADNOC, the Abu Dhabi Oil Refining Company (TAKREER). This was set up as part of a major restructuring of ADNOC (see below). The emirate's first refinery – at Umm al-Nar – started up

in 1976 with a capacity of 15,000 b/d. This was increased to 60,000 b/d in 1983 and 72,000 b/d in 1988. In 1993 capacity was increased again to 85,000 b/d and currently stands at 90,000 b/d. A chlorine plant was started in 1981 with a capacity of 15,000 tons per annum (t/y).

The Ruwais refinery was commissioned in 1981, with a capacity of 120,000 b/d. Hydrocracking facilities of 27,000 b/d were added in 1985. Because of its remote location, a general utilities plant was also established at Ruwais, to produce 90 MW of electricity and 26,000 cu ms of clean water. In 1995, plans were announced for a US \$1.2 billion expansion scheme to increase crude distillation by 135,000 b/d, and install a new vacuum distillation facility, a hydrocracker and a delayed coker. A year later, following a thorough review, ADNOC decided to delay by three to five years the implementation of the project. In June 1996, the export of condensates from Ruwais began at a new berth, following the commissioning of a major gas recycling project targeting the Thamama C and F non-associated gas reservoirs underlying the onshore Bab oilfield. In June 1997, Snamprogetti of Italy was awarded contracts to build two 140,000 b/d condensate distillation trains and related sweetening units at the Ruwais refinery. The two trains were commissioned in 2000 (the first in May, the second in July), thus tripling the refining capacity at Ruwais and eliminating the export of condensate. TAKREER's total refining capacity in the middle of 2000 exceeded 500,000 b/d.

At the same time, the general utility plant at Ruwais was being expanded to produce 500 MW of electricity and 8 mn gallons of water. ADNOC awarded a US \$600 million contract to the international electrical engineering conglomerate, the ABB Group, to carry out the project which was being completed in 2000. Expansion of the capacity of the sulphur handling terminal (built in 1992), from 4200 t/y to 6200 t/y, was undertaken in the same year. Molten sulphur is shipped from Das Island and taken to Ruwais for processing. The Abu Dhabi National Tanker Company (ADNATCO) has a vessel dedicated to this route.

The impact on the environment has become an integral design consideration for new projects and plants. The demand for gasoline and gas oil in the UAE was forecast in 2000 to grow by 3.5–4 per cent a year. According to the manager of TAKREER's Process Technology & Studies Department, 'Abd al-Muhsin al-Hammadi, in an address to the eighth Annual Middle East Petroleum & Gas Conference in Abu Dhabi in March 2000, TAKREER's ability:

to make unleaded gasoline at Ruwais has been demonstrated and some quantities are manufactured as required. Similarly, sulphur in the gas oil has been voluntarily reduced from both the Ruwais and Umm al-Nar refineries. The decision to produce unleaded gasoline, to phase out leaded gasoline production and reduce the sulphur in gas oil in the long-term has been taken in principle, and the optimum configuration is under evaluation. Facilities are expected to be commissioned in 2004.

In the shorter term, the company's strategy is to increase the capacity of existing refineries to achieve a high reformate octane level and lower benzene and sulphur content with the minimum investment. Back in 1997, ADNOC had released tender documents for what was called the unleaded gasoline package. This included the installation of a host of units related to the production of unleaded gasoline as well as naphtha, liquid petroleum gas, gas oil treating and sulphur recovery. No contracts have been awarded as yet.

TAKREER is awaiting the results of a feasibility study being carried out by the US's Bechtel before deciding whether to build a Dh 1.47 million (US \$400 million) lube base oil refinery

with a capacity of 300,000 t/y. If the project is approved, the refinery, integrated with the existing one at Ruwais, will be scheduled for commissioning in 2004. In 1997, ADNOC announced plans for a lube base oil refinery with output of 250,000 t/y, to come on stream in 2001, but the project has been delayed.

The Structure of Abu Dhabi's Oil Industry

Oil policy for Abu Dhabi is determined by the Supreme Petroleum Council that was set up in June 1988. Its chairman is the Crown Prince of Abu Dhabi and Deputy Supreme Commander of the UAE Armed Forces, Sheikh Khalifa bin Zayed Al Nahyan, and its Secretary-General is Yusif bin Omair Yusif, the Chief Executive Officer of ADNOC. Among the Supreme Petroleum Council's responsibilities is management control of ADNOC. This company in turn owns a range of subsidiaries in the UAE and overseas which specialize in upstream and downstream oil and gas operations, as well as distribution, shipping and all other aspects of the hydrocarbons industry.

Aside from ADCO, ADMA-OPCO and ZADCO, the oil companies mentioned above, ADNOC owns or has a majority shareholding in: ADNOC for Distribution (ADNOC-FOD), Abu Dhabi Drilling Chemicals and Products (ADDCAP), Abu Dhabi Gas Industries Company (GASCO), Abu Dhabi Gas Liquefaction Company (ADGAS), Abu Dhabi National Tanker Company (ADNATCO), Abu Dhabi Petroleum Ports Operating Company (ADPPOC), the Liquefied Gas Shipping Company Ltd (LGSC), the National Drilling Company (NDC), the National Marine Services Company (NMS), Natural Gas Shipping Company (NGSCO), National Petroleum Construction Company Ltd (NPCC), the Ruwais Fertilizers Industries Ltd (FERTIL), the Abu Dhabi Polymers Company Ltd (Borouge), the Abu Dhabi Oil Refining Company (TAKREER) and the Abu Dhabi Gas Company (ATHEER).

In 1999, ADNOC underwent a major reorganization to improve internal efficiency and effectiveness, reflecting the results of an internal study that had looked at all aspects of the company. Operational activities that had been supervised directly by ADNOC were converted into five autonomous business units to enhance accountability. One directorate is responsible for planning, directing and guiding the company's growing petrochemical interests. Another manages the increasingly high-profile gas sector. Other directorates are responsible for exploration and production, marketing and refining, and shared services. In addition, a projects management policy requires that project teams work under the direct supervision of the company or directorate which is responsible for implementing the specific venture. Previously, all project work was carried out by ADNOC's project directorate with little coordination among different areas of the organization. Three other directorates – relating to finance, management support, and human resources and administration – provide the five business line directorates with support services. The heads of all eight directorates report to ADNOC's Chief Executive Officer, Yusif Omair bin Yusif.

Abu Dhabi's Involvement in Overseas Operations

Aside from developing its own oil industry, Abu Dhabi has investments in several overseas ventures through the government-owned International Petroleum Investment Company (IPIC).

In 1997, the value of IPIC's shareholding in the publicly listed OMV of Austria (in which IPIC has a 19.56 per cent stake) and Compania Espanola de Petroleos (Cepsa – IPIC's stake, 9.54 per cent) of Spain was estimated at US \$881.9 million. (Cepsa is a company engaged in oil refining and distribution, as well as crude production, in Algeria.) IPIC also has a 30 per cent stake in the Pakistani company, Pak-Arab Refinery Ltd (Parco) and a 48 per cent stake in another Pakistani company, Pak-Arab Fertilizers Ltd (Pafco). Parco owns and operates an 864 km product pipeline from Karachi to Multan in central Pakistan. IPIC and Pakistan signed an agreement late in 1997 to build a 100,000 b/d joint venture refinery in Multan. Pafco owns and operates a fertilizer complex at Multan with a capacity of 850,000 t/y.

In October 1999, IPIC announced that it had reached an agreement with South Korea's Hyundai Group to acquire a 50 per cent controlling interest in the latter's Korean oil refining and marketing subsidiary, Hyundai Oil Refinery Company (HDO), with Hyundai affiliates retaining the other 50 per cent. The 50 per cent acquisition was effected through the purchase by IPIC of new HDO shares to the value of Won 612.7 billion (US \$510 million). After its acquisition of Hanwha's Inchon Oil Refining Company, HDO had an effective refining capacity of 665,000 b/d–390,000 b/d at Hyundai's Daesan refinery and 275,000 b/d at the Inchon plant. IPIC, as well as acquiring a controlling interest in HDO, effectively has control of management, appointing four out of seven directors on the board.

The Oil Industry in Dubai and the Other Emirates

Dubai is the next largest oil producer in the UAE after Abu Dhabi; but its output is decreasing. In the mid-1990s, production was running at around 230,000 b/d, but the Crown Prince of Dubai and UAE Defence Minister, Sheikh Muhammad bin Rashid Al Maktoum, said in March 2000 that production had dropped to 170,000 b/d in the previous year. Press reports indicate that Dubai's reserves would be exhausted within 20 years. The major player in Dubai oil is the Dubai Petroleum Company (DPC) which is a wholly-owned subsidiary of Conoco of the US. It is the operator in a consortium comprising itself (32.5 per cent), Totalfina-Elf (27.5 per cent), Repsol of Spain (25 per cent), RWE-DEA of Germany (10 per cent) and Wintershall (5 per cent). DPC discovered the four major offshore oilfields, Fateh, Southwest Fateh, Rashid and Falah between 1966 and 1976. Dubai's oil production peaked in 1991 at 410,000 b/d and has been steadily declining ever since. But production of condensate from the onshore Margham field is running at around 25,000 b/d. Margham, previously operated by Arco International Oil and Gas Company, is now run by the Dubai Margham Establishment, which is wholly owned by the Government of Dubai and chaired by Sheikh Ahmed bin Saeed Al Maktoum.

A condensate refinery began production at Jebel Ali in May 1999. In June 1997, the Dubai government-owned Emirates National Oil Company (ENOC) awarded a US \$137 million contract to Technipetrol, the Italian subsidiary of France's Technip, to carry out the first phase of the project with a refining capacity of 60,000 b/d producing mainly jet fuel, diesel and naphtha for local consumption. The plan was that in the second phase, output would be increased to 100,000 b/d, but in January 1998, ENOC awarded Technipetrol a new contract, worth US \$46 million, to double production at the refinery from 60,000 b/d to 120,000 b/d. This gives the refinery five Merox units to process condensates from the Gulf region into

34,000 b/d of kerosene, 11,500 b/d of diesel, 5000 b/d of liquefied petroleum gas (LPG) and 33,000 b/d of naphtha. The refinery is owned and operated by ENOC's wholly-owned subsidiary, ENOC Processing Company.

Dubai has three terminals from which oil and LPG is exported: Jebel Ali, Port Rashid and Fateh. On the domestic front, ENOC and Caltex announced in January 1997 that they had set up a joint company to produce and market engine oil and lubricants in the UAE. The new company – Emirates Petroleum Products Company (EPPCO) Lubricants – acquired a lubricating oil plant in Dubai owned by Caltex. ENOC was established at the end of 1993 by the Dubai government with a fully paid up capital of Dh 100 million (US \$27 million) to promote joint venture petroleum projects inside and outside Dubai. It has a 60 per cent share in EPPCO, with Caltex holding the remaining 40 per cent. EPPCO markets petroleum products in the northern emirates of the UAE. Early in 2000, ENOC revealed that it, too, intended to move into the domestic petroleum retail market, setting up 30 gasoline stations in Dubai and other emirates. Thus ENOC would not just face competition from EPPCO, but also from ADNOC for Distribution (ADNOC-FOD) and Emarat, the UAE's two other gasoline retailers.

Another wholly-owned subsidiary of ENOC, the Dubai Shipping Company, ordered two small tankers in 1998 from Daewoo of South Korea. The two double-hulled tankers were due for delivery in the first half of 2000. The vessels were ordered to handle imported feedstock for the Jebel Ali condensates refinery.

Dubai's northern neighbour, Sharjah, is the third largest hydrocarbon producer in the UAE, with oil production centred on the offshore Mubarak field. This lies close to an area occupied by Iran, and the northern part of the field lies in an Iranian concession area. As a result, while Sharjah has drilling and production rights, it shares production and revenue with Iran. At the same time, 20 per cent of Sharjah's remaining revenue is shared with the emirate of Umm al-Qaiwain and 10 per cent with Ajman. Sharjah's hydrocarbon resources are confined largely to natural gas (see later in this chapter) and condensates. Crescent Petroleum, through its wholly-owned subsidiary, Buttes Gas & Oil International, brought the Mubarak field on stream in 1974, with output of 60,000 b/d. By the mid-1980s, production had dropped to 5000 b/d. At this stage the acreage was divided in the following way: Crescent (80 per cent), Finland's Neste Oy (12.5 per cent), Bahrain-based Intoil (7.5 per cent). A ten-year field development programme was started in 1986 to bring production up to 20,000 b/d. At the end of that period, Crescent's partners pulled out, and a farm-in agreement was signed with Enterprise Oil of the UK. In May 1998, Crescent announced that it had started exploratory drilling of the Khatir Number One well – with production to be hooked up to the Mubarak field. The work was being carried out under the terms of an agreement between Crescent and Enterprise Oil to boost production from the Mubarak field. The agreement provided for Enterprise to spend around US \$25 million on a 3-D seismic survey and the drilling of at least two exploration wells in return for a 40 per cent share of the new wells. Early in 2000, production from the Mubarak field was estimated at 6000 b/d.

Despite the paucity of its oil prospects, the ruler of Sharjah, Sheikh Sultan bin Muhammad Al Qasimi, issued an Amiri decree in October 1999 establishing the Sharjah Petroleum Council. This supersedes the Sharjah Department of Petroleum and Minerals which was set up in 1972. The Council's task, among others, is to draw up the emirate's policy regarding the production and processing of oil, as well as all other matters related to oil.

In mid-1999, a small refinery in the Sharjah free trade zone of al-Hamriyah began operations. It is run by the Sharjah Refining Company (SRC) – an affiliate of the Fal Group of the UAE. The refinery, which cost some US \$250 million and was bought second-hand in Canada, was put together in three phases. The first phase consisted of a 16,000 b/d crude distillation unit and a 7500 b/d reformer.

The search for oil in Ra's al-Khaimah has been continuing since 1967, with the emirate estimated to have reserves of 400 million barrels of oil and condensate. Offshore production from the Saleh field has fallen from an initial rate of 11,000–12,000 b/d and is now suspended. In June 1998, the Ra's al-Khaimah Oil and Gas Company said that it had failed to find any hydrocarbons at its offshore exploration well Aman-1 which had been spudded in February that year. The well had been drilled to a depth of 17,580 ft.

Fujairah's involvement in the oil industry is limited to refining – and that operation has not been without its difficulties. But in January 2000 prospects seemed brighter after an announcement by the Department of Industry and Economy in Fujairah that the Bermuda-registered Metro Oil Corporation had reached agreement with its creditors to reopen its refinery in the emirate within three months. Operations there had stopped in March 1998 when Metro Oil's parent company, Athens-based Metro Trading International, filed for bankruptcy. It was declared bankrupt the following month by the First Instance Court of Athens. The Fujairah Department of Industry and Economy said that after reviewing technical and financial studies conducted by the parties concerned in settling the Metro Oil affair, it had decided 'that the reoperation of the Fujairah refinery in the present circumstances is feasible taking into account the relative improvement in oil prices and increase in demand for oil products.' The statement added that a license was being granted 'to operate the refinery under the management of an operator with an international reputation and to form the Fujairah Refinery Co Ltd to undertake the project.'

The new company is expected to expand production at the refinery from 75,000 b/d (its capacity at the time of its closure) to 90,000 b/d and extend its range of products to include jet fuel and kerosene as well as the fuel oil and gasoline which were produced in the past. Before its collapse, Metro Trading was one of the main movers of long-haul fuel to the Singapore market for bunkers. Under the restart-up plans, new jetties will be built at Fujairah port, and dredging will be carried out to a depth of 15 metres to accommodate larger tankers. Texaco Inc and Swiss-based Glencore International were reported to have agreed to supply the necessary crude to operate the refinery at full capacity. The main creditors, which include Credit Lyonnais, Banque Nationale de Paris, Fujairah National Bank and Credit Agricole, along with Texaco and Glencore, will be repaid from revenue earned by the refinery. It was further reported at the time that Vopak (formerly Van Ommeren) was holding talks on operating the Fujairah refinery. Vopak and the Emirates National Oil Company were said to be planning to connect the refinery with their adjacent storage terminal by means of two pipelines (one for crude and the other for products). Fujairah, situated on the eastern coast of the UAE close to the Straits of Hormuz, the gateway to the Gulf, has become a major bunkering centre for the region. The emirate is continuing to expand its oil products storage capabilities. A 20-tank storage farm, built at a cost of US \$84 million and run by Vopak, was opened early in 1999: towards the end of the year a contract was awarded for the construction of six more tanks. The tank farm is used to distribute products to regional markets such as Pakistan, India and East Africa.

Fujairah, Ajman and Umm al-Qaiwain remain the only three emirates where no oil deposits have been located, although exploration has been carried out in the all three, all of which remain optimistic that commercial quantities may one day be discovered. In February 2000, the ruler of Ajman, Sheikh Humaid bin Rashid Al Nu'aimi, issued a decree setting up the Ajman Petroleum Department to take over all aspects of the emirate's oil and gas industry, onshore and offshore. The new government body was charged with supervising upstream and downstream activities and advising on policy. The Supreme Chairman of the department is Sheikh Ahmad bin Humaid Al Nu'aimi.

The UAE on the World Oil Stage

Abu Dhabi joined OPEC in the late 1960s; but since the formation of the union in 1971, representation at the organization has been in the name of the UAE, with Abu Dhabi acting as the swing producer, altering its production to conform with OPEC quota changes, thus leaving Dubai, with its much smaller output, unaffected. Within OPEC, the UAE – the sixth largest producer – is regarded as a moderate state, seeking a balance between production and price that will satisfy producers and consumers alike. The UAE's production was limited by OPEC quotas in 1999 to 2 mn b/d (a reduction of 157,000 b/d). This restricted output to approximately the following amounts, which were subject to change from time to time: ADCO 900,000 b/d; ADMA-OPCO 380,000 b/d; ZADCO 450,000 b/d; other Abu Dhabi operators 70,000 b/d; and Dubai 200,000 b/d. Abu Dhabi had around 500,000 b/d spare capacity in the first quarter of 2001.

Gas: The UAE's Fuel for the Future

Oil has underpinned the development of the UAE thus far, but there are growing signs that natural gas will be playing an increasingly big role for the Emirates as a whole throughout the twenty-first century. Not only does the UAE own vast reserves of its own, but it is also taking the initiative in developing the Emirates as a hub from which to supply a network that will benefit the entire Gulf region – and possibly countries further afield at a later stage.

Once again, Abu Dhabi has been blessed with the biggest reserves – as much as 90 per cent of reserves are within the territory or under the waters of that one emirate, although a lot of the gas is sour and relatively expensive to produce. Abu Dhabi can take the credit for being one of the first states in the region to realize the value of gas – most of which was previously flared off in all the oil-producing states. As early as 1977, the Abu Dhabi Gas Liquefaction Company (ADGAS) built an LNG plant on Das Island to process associated gas. Initially the plant had two trains, and a third was added in November 1994. As well as LNG, this plant produces smaller amounts of liquefied petroleum gas (LPG), pentane and sulphur. The plant's nameplate capacity is 5.5 mn tons per year (t/y), but production has frequently been in excess of that figure. Since 1992, gas has been produced from Abu Dhabi's share of the vast Khuff reservoir – one of the largest in the world – under the Abu al-Bukhoosh and Umm Shaif oilfields.

The venture's principal long-term customer is the Tokyo Electric Power Company (Tepco) which signed a 20-year contract beginning in 1977 to buy 4.3 mn t/y of LNG, with an option

of lifting additional quantities of up to 4.9 mn t/y, plus a much smaller quantity of LPG. The contract was extended by another 25 years in 1994. Tepco imports about 30 per cent of its gas supply from ADGAS. In May 1997, ADGAS took delivery of its fourth LNG carrier from Kvaerner-Masa Yards of Finland to carry LNG to Tepco's power plant in Japan. The National Gas Shipping Company (NGSCO) operates the carriers. These replaced four other tankers that had been on long-term charter. As well as the Tepco deal, ADGAS has signed a series of short-term supply contracts with another firm in Japan as well as customers in South Korea, Spain, Italy and Belgium.

ADGAS's other major long-term contract, for the supply of LNG to India, was signed in 1999. Under the deal, ADGAS will provide Enron's Indian affiliate MetGas with 500,000 t/y of gas for a 20-year period beginning in 2001. The deal to supply gas for Enron's Dabhol power plant in Maharashtra state had been due for signature at the end of 1998, but was delayed for scheduling reasons. LNG from Abu Dhabi as well as larger volumes from nearby Oman will be used to meet the fuel requirements of the 2450 MW power station.

The Indian company will need some 2.1 mn t/y of LNG to fuel Dabhol once the power plant's second 1624 MW phase is commissioned in October 2001 and the first 826 MW naphtha-fired stage is converted over to gas. The Dabhol Power Company has been running the plant on a commercial basis since early this year after beginning testing operations at the end of 1998. While ADGAS has signed on to supply some 500,000 t/y of LNG, the sales and purchase agreement with MetGas allows the buyer to exercise more downward flexibility in the initial period of the 20-year contract. This is required as a safeguard against operating difficulties or lower than anticipated running rates once the first phase of the power plant shifts to gas and the second stage is started up. MetGas is providing the shipping capacity necessary to transport the volumes to a 5 mn t/y receiving terminal it plans to build at Dabhol. Because the MetGas deal did not start until 2001, ADGAS had spare capacity for short-term supply contracts in the intervening period.

As for the development of the Khuff gas zones in the Umm Shaif and Abu al-Bukhoosh regions, the original plan was to drill five new wells at Abu al-Bukhoosh, which would be connected to a new gas-processing platform. Gas would then be piped ashore via a 165-kilometre subsea pipeline to a treatment plant at Taweelah after which it would be used for power and industrial projects in Abu Dhabi and Dubai. The two emirates signed an agreement in February 1998 under which Abu Dhabi would supply Dubai with 500,000 cubic feet/day (cfd) of natural gas beginning in 2001. In March 1999, construction firms bidding for the offshore portion of the project were told that it had been cancelled. Instead, ADNOC decided to source the gas needed to supply Dubai from ventures in Abu Dhabi's onshore sector. A second gas supply scheme known as the Onshore Gas Development Phase-2 (OGD-2) project is currently under construction at the Bab field. When it comes on stream in early 2001 it will add an incremental 1 bn cfd of sales gas into the domestic network, although it could take some time before industrial users in Abu Dhabi are able to absorb the additional supply from OGD-2. Analysts reckon that for several years after the project is brought on-line there will be somewhere in the range of 400 mn to 500 mn cfd of spare capacity at Bab's Habshan gas plant. This excess could be used to supply Dubai as well as a planned second-phase expansion at the Taweelah A power and desalination complex. Contractors in 2000 were constructing a new pipeline connection to the Maqta/Taweelah manifold as part of the ongoing OGD-2 project. The

existing power plant at Taweelah is already linked into the domestic network through an overland pipeline spur from Maqta.

At one time ADNOC suggested that it might fast-track OGD-3, a third onshore gas development project, to meet Dubai's long-term needs, but the gas involved is extremely sour, with huge amounts of hydrogen sulphide and carbon dioxide. Moreover the cost of developing these reservoirs has been estimated at over US \$2/mn BTU, double the US \$1/mn BTU required to for OGD-2. Completion of OGD-2 – developing the Thamama C and D gas reservoirs – was due by the end of 2000. It will provide an additional 1100 mn cfd of raw gas, with 950 mn cfd being sold to meet the needs of the expanding power and desalination sector, industrial users and the condensate splitter at the Ruwais refinery. As part of the onshore development, the Asab Gas Development project – a new grassroots facility to process the natural gas from the Thamama F and G reservoirs in the Asab field – was also due for completion in 2000. This has the capacity to produce and gather 825 mn cfd of gas, produce 100,000 b/d of condensate, and reinject 825 mn cfd of sour gas into the various reservoirs. A pipeline will transport condensate to the Ruwais refinery. With the commissioning of the two condensate splitters at Ruwais, exports of condensate from Thamama C and D (100,000 b/d) were to stop. Instead, the condensate from there and a similar amount from Thamama F and G were to be piped to Ruwais for the production of naphtha. The decision to switch from the export of condensates to naphtha reflects the fact that the latter commands a higher price on international markets.

Another major facility at Ruwais is the natural gas liquids processing plant operated by Abu Dhabi Gas Industries Ltd (GASCO). This produces around 6 mn t/y of propane, butane and pentane. Output was increased after debottlenecking was carried out in 1996.

Gas for Abu Dhabi's Power and Petrochemicals

The Chief Executive Officer of ADNOC, Yusif Omair bin Yusif, speaking towards the end of 1999 outlined the emirate's gas strategy: 'Abu Dhabi's main future gas policy is to develop gas resources to meet growing domestic demand, giving priority to generating water and electricity, supply of gas to new industries, petrochemical projects and any re-injection needs.'

Estimates of the gas supply needed to meet these requirements all point to a sharply rising demand in the coming decade. Abu Dhabi's gas supply in 2001 is projected at approximately 5.7 bn cfd – consisting of 2.46 bn cfd from condensate gas, 1.62 bn cfd from the Khuff offshore production and 1.62 bn cfd from associated gas. However, demand projections show that power generation and industrial consumption will increase from 1.78 bn cfd in 2001 to 2.1 bn cfd in 2005, and that demand for reinjection will grow substantially from 2.57 bn cfd to 4.25 bn cfd during the same period as Abu Dhabi's oilfields continue to mature, while LNG demand will remain constant at around 1.1 bn cfd. These demand estimates leave a shortfall of nearly 1 bn cfd by the year 2005, and the supply deficit is projected to widen ever further to more than 3 bn cfd by 2015.

Much of the focus in the development of gas-based industries in Abu Dhabi is on the development and expansion of power/water desalination plants, with the private sector playing a major role. The UAE as a whole is acknowledged by other Gulf states as the leader in this field of activity.

Three major privatized power/desalination projects are under way in Abu Dhabi. The Abu Dhabi Water and Electricity Authority (ADWEA), in mid-2000, was considering bids for the construction of a US \$408 million private power/water plant near Jebel Dhanna, 250 km west of Abu Dhabi city. Commercial operations of the first power units are expected to start before summer of 2003, with the whole plant becoming operational the following year. In the first phase, the plant will generate 1500 MW of electricity and produce 100 mn gallons/day (g/d) of fresh water. Output will later be expanded to 5000 MW and 200 mn g/d, making it the biggest project of its kind in the UAE and enabling ADWEA to extend the power distribution grid to Al Ain.

Two other private power/water projects are under way in Abu Dhabi. In October 1998, CMS Energy Corporation of the US reached agreement with ADWEA on the construction, privatization and operation of the US \$740 million Taweelah A-2 project. The consortium, Totalfina-Elf and Tractebel of Belgium, were the successful bidders for Taweelah A-1. When refurbishment of al-Taweelah A-1 is complete, output will be around 1050 MW of electricity and 70 mn g/d of water.

Demand for power and water in Abu Dhabi is increasing by 8 per cent a year, according to the Deputy Director of ADWEA, 'Abd Allah Al Nu'aimi, speaking in the first quarter of 2000. At present the emirate is generating 3500 MW of electricity and producing 262 mn b/d of water. Output is expected to rise to 6964 MW/400 mn b/d by 2005 and 7536 MW/573 mn b/d by 2010. Mr Nu'aimi said the privatization schemes were part of a new drive towards cost reduction.

Abu Dhabi is also taking steps to develop and expand its petrochemicals sector. Construction of a 600,000 t/y ethylene plant in the Ruwais industrial area was under way in mid-2000. The project, which will also contain two 225,000 t/y polyethylene plants, is being carried out by Borouge, a joint venture owned 60 per cent by ADNOC and 40 per cent by Borealis. Borealis is 50 per cent owned by Norway's Statoil and 25 per cent each by Austria's OMV and Abu Dhabi's downstream investment arm, IPIC. The ethane-based cracker will supply feedstock to the two polyethylene plants and ADNOC's planned dichloride plant. Borouge will be producing high-density and linear low-density polyethylene. Borouge Singapore will handle marketing of the products.

While Borouge is a newcomer, the Ruwais Fertilizers Industries Ltd (FERTIL), which is owned by ADNOC (63.75 per cent) and TotalFina Elf (33.25 per cent), began production of ammonia and urea in 1984. By 1994 the output of the two was 600,000 t/y.

Rising Gas Demand in Dubai

In the northern emirates, by far the largest market for gas is Dubai, the trading and commercial hub of the UAE and the Gulf region as a whole. The emirate produces limited amounts of gas itself, and this is not nearly enough to meet the rising demand from its fast-expanding industrial sector. At present, its major source of gas (up to 400 mn cfd) is its northern neighbour, Sharjah. Production from the onshore Saja'a field, situated to the west of the Hajar Mountains, began in 1982 and from Moveyeid in 1992. Later the same year a major gas and condensate discovery was made at Kahaif, to the south. In December 1992, BP Amoco Sharjah Oil Company announced it would be drilling two gas wells to increase natural gas and condensate production. At the time, BP Amoco was producing more than 650 mn

cfd from Saja'a, Moveyeid and Kahaif. Condensate from the three fields was almost 30,000 b/d. The major customers for BP Amoco Sharjah gas are the Sharjah Electricity and Water Authority, the Dubai Supply Authority and the UAE Ministry of Electricity and Water. In September 1999 another operator, Sharjah-based Crescent Petroleum and its partner Atlantis Holding Norway AS, announced that significant quantities of hydrocarbons had been discovered at the offshore Sharjah-2 well. This was the first well drilled by Crescent/Atlantis in the 1018 sq. km block, which runs from the Sharjah coastline to the Crescent-operated Protocol Area where the Mubarak field is located.

Other customers for gas, apart from the Dubai Supply Authority, are the Dubai Electricity and Water Authority, several petrochemical and fertilizer plants located at Jebel Ali – as well as the Dubai Aluminium Company (Dubal), which in March 2000 inaugurated its US \$736 million Condor expansion project, making Dubal the second largest smelter in the world and the largest in the Middle East. The plant can generate 440 MW of electricity and produce 148,000 t/y more aluminium with a negligible increase in natural gas consumption.

All these projects are swiftly pushing up the demand for gas in Dubai. In 1998, power generation and water desalination consumed around 380 mn cfd, with peak demand rising to 500 mn cfd. Government forecasts project demand growth rates for these two sectors at between 8 per cent and 9 per cent annually through to the year 2010. Dubal in 2000 was consuming an estimated 240 mn cfd. Other industries in Dubai (existing or under construction) used 70 mn cfd in 1998 and this figure is set to rise to 90 mn cfd by 2005.

Abu Dhabi agreed in February 1998 to supply 500 mn cfd of gas to Dubai. Abu Dhabi first considered supplying this gas from its offshore Khuff project. But, as described earlier, it decided to source the gas initially from its OGD-2 development. In February 2000, work began on constructing a 112 km pipe from the al-Taweelah processing plant in Abu Dhabi's Maqta' district to the Jebel Ali industrial zone in Dubai. But the plan is that, at a later stage, gas from Qatar will reach Dubai via this pipeline.

The idea of the Qatar connection arose out of a realization on the part of the UAE leadership in 1999 that the scope of the demand for natural gas in the Emirates and elsewhere in the Gulf was rising so rapidly that new and much broader strategic thinking was required. This led to the birth of the most ambitious gas distribution scheme ever attempted in the Middle East: the Dolphin initiative.

The Dolphin Initiative – Qatar's Gas For UAE and Oman

The United Arab Emirates Offsets Group (UOG) is the body that handles the investments which foreign companies making military sales are required to place in the Emirates. Early in 1999, UOG came up with the idea of bringing gas to the UAE market – and to Dubai in particular. The logic is obvious. Qatar, in its offshore North field, has one of the biggest reservoirs of gas in the world. It needs to find a market, and Dubai needs to find a new source of supply. So the UOG suggested the building of an 800 km undersea pipeline from the North field to a landfall in Abu Dhabi. From there the gas would be piped overland, first to Jebel Ali and then on to Oman, and at some much later date, the pipeline might be extended to the Indian subcontinent. The scheme was named the Dolphin initiative.

Throughout 1999 and in the early months of 2000, UOG began putting together a chain of preliminary agreements to prepare for the launch of Dolphin. In June 1999, UOG signed a Memorandum of Understanding (MOU) with the Dubai Supply Authority for the delivery of 200–700 mn cfd of gas from the Dolphin project. Furthermore, under a joint declaration by ADNOC and Dolphin in November the same year, the latter agreed to supply the 500 mn cfd which Abu Dhabi had agreed (in February 1998) to supply to Dubai – depending on the latter's approval. By the first quarter of 2000, Dolphin still had not finalized with Dubai exclusivity over gas sales to the emirate, the volume requested and the price.

In June 1999, UOG signed two more MOUs with potential customers for Dolphin gas. The first was with Oman for the supply of 300–600 mn cfd on a long-term basis. The second was with Pakistan for the supply of up to 1.5 bn cfd. Then in July UOG and Mobil Oil Qatar signed an MOU to start negotiations on developing a long-term supply and purchase agreement for initial gas supplies from the North field of 300–500 mn cfd. In the short term the Qatari government has indicated that the gas will be supplied by existing concession holders. At a later stage UOG will be granted the right to develop gas reserves in the North field.

Then in March 2000 came an announcement from UOG that they had reached an agreement with the US's Enron and France's Elf (a subsidiary of Totalfina) on a strategic partnership to implement the Dolphin initiative. The formation of the partnership represented a major step forward for Dolphin and set the stage for detailed negotiations with potential customers for the proposed gas network. UOG will hold a 51 per cent majority shareholding in the new partnership, with the remainder split equally between Enron and Elf. (The Elf name has been retained for the merged company's Middle Eastern operations for legal reasons, and is expected to remain in use for some time.) The Project Development Agreement (PDA) foresees the partnership lasting a minimum of 25 years, and its initial goal will be to develop the resource-base part of the project. Elf's contribution will be to ensure that the upstream part of Dolphin is completed as cost-effectively as possible, while Enron will oversee the midstream, particularly pipeline construction and operation, as well as raising and managing capital for the venture.

President and CEO of Enron, Jo Sutton, said that the venture partners would focus in the near term on the construction of a pipeline from Qatar to Dubai via Abu Dhabi. He predicted that within 12–18 months the group would begin construction of the first phase, with a view to completion in late 2002 or early 2003. Initial deliveries to Abu Dhabi are expected to reach around 1.2 bn cfd of gas, expanding to 3 bn cfd over 2–3 years as the customer base grows. Of this amount, 80 per cent is earmarked for use in the UAE, and this will include the 500 mn cfd which Abu Dhabi has contracted to supply to Dubai. A decision on extending the supply line to Oman 'will depend on whether we want to supply more gas within the UAE or to sell to Oman.'

The cost of the production facilities and the pipeline from Qatar to Abu Dhabi, Dubai and Oman is predicted to total about US \$4 billion, of which US \$2–3 billion is expected to be spent on production and processing and US \$1–2 billion on the pipeline. The overall capital cost of taking gas to these markets and building the power projects and industrial plants linked to the gas stream is projected to be US \$8–10 billion, much of which is to come from the customers. Besides potential power schemes, UOG is hoping to line up energy supply contracts to LPG, petrochemical, fertilizer, ammonia and other industrial producers in the region. According to the former Chairman of UOG, Dr Amin Badr el-Din, 'lots of this gas demand is driven by the need for power generation

in the region; also, many industrial developments are being held up by a lack of gas in the UAE and Qatar. It is the same in Dubai, too, where a number of projects are waiting to be sanctioned.’

With its decision to launch the Dolphin project, the UAE is taking the initiative in developing the first links in an intra-Gulf gas network, a concept that has been much discussed. Beyond that, the UAE could become the hub for an even wider gas distribution system, with pipelines extending to Pakistan at first, and possibly as far as India at a later stage. While sceptics cast doubt on the possibility of a gas pipe being laid on the sea bed deep under the Indian Ocean, UAE officials say they are determined to see if a way of overcoming current obstacles can be found.

UAE Oil and Gas – an Environmentally Sound Future

Having established itself as one of the major players in the international oil and gas industry and an innovator in intra-Gulf cooperation, the UAE is setting its sights on responsible, secure and environmentally safe development in the century ahead. Despite the fact that the role of gas is increasing fast, the UAE does not believe that the oil era is over or that its demise is imminent. Nevertheless, leading figures in the UAE’s oil industry believe that further study is needed to see how the continued expanded use of oil as a power source could be made to be compatible with the growing awareness and concern around the world about preserving the environment. This point was made by the Chairman of ADNOC, Yusif bin Umair Yusif, in a speech opening the eighth Middle East Oil & Gas Conference in Abu Dhabi in March 2000. Some commentators, he said, defined the Kyoto Protocol to reduce the emission of greenhouse gases as the beginning of the post-oil age. Research was being carried out into developing alternative automotive fuels. ‘But our concern,’ the ADNOC Chairman said, ‘is that resources should be effectively targeted and the full cost should be taken into account, both financially and to the environment.’ Electricity, for example, still has to be generated from primary energy sources; and there is transmission loss in moving it and difficulty in storing it. ‘In the Middle East,’ Mr Yusif went on:

we are sitting on top of two thirds of the world’s proven oil reserves and they are relatively low cost to develop. The gasoline and diesel fuels which are refined from these crude oils are reliable, cheap and efficient, with a long successful track record. It would be beneficial for us and the world if more research into the production of these hydrocarbon-based transportation fuels is undertaken, which will make them even more environmentally friendly and will maintain and enhance their attraction for many more decades. We believe these conventional transportation fuels will remain more economically viable than the alternatives and merit more intensive research than they are currently receiving.

The UAE which, from the earliest days of oil discoveries, has demonstrated its realization of the need for constant technological improvements in the oil industry to keep pace with the world at large and the necessity to strive for an increasingly efficient and safe industry, is ideally suited to act as a catalyst for the research needed to adapt oil products to the stringent environmental regulations of the twenty-first century. Given the UAE’s determination to keep its place among those nations that are quick to realize the need of oil producers to adapt to changing circumstances and consumer demands, it can look forward to many more decades in which its oil and gas industries will provide a secure and dynamic base for economic growth.

UAE Oil and Gas Statistics

Table 1. Crude oil production 1978–1999 (thousand b/d)

1978	1,830.5
1979	1,830.7
1980	1,701.9
1981	1,502.3
1982	1,248.8
1983	1,149.0
1984	1,069.0
1985	1,012.6*
1986	1,146.0*r
1987	1,281.1*r
1988	1,359.4*r
1989	1,641.3*
1990	1,818.5*r
1991	2,093.6*r
1992	2,241.1*r
1993	2,159.3
1994	2,166.5
1995	2,148.0
1996	2,161.3
1997	2,160.7
1998	2,255.3
1999	2,071.0

* – provisional or estimated figure. r – revised.

Source: OPEC

Table 2. Crude oil exports by destination 1994–1998 (thousand b/d)

Destination	1994	1995	1996	1997	1998
North America	23.6	–	1.4	–	2.5
Latin America	10.0	–	–	–	7.5
Eastern Europe	–	–	–	–	–
Western Europe	61.7	2.0	0.7	2.0	13.0
France	1.4	–	0.1	–	11.2
Germany	0.6	–	–	1.0	–
Italy	–	–	–	–	–
Netherlands	–	–	–	1.0	–
UK	–	–	–	–	1.3
Africa	30.0	36.0	40.9	40.0	57.0
Asia and Far East	1,751.6	1,828.9	1,843.6	1,846.9	1,924.1
Japan	1,212.9	1,215.0	1,195.1	1,213.4	1,205.0
Oceania	78.1	58.1	56.6	60.1	34.9
OECD	1,376.3	1,273.0	1,253.8	1,275.5	1,255.4
Total World	1,955.0	1,925.0	1,943.2	1,949.0	2,039.0

Source: OPEC

Table 3. Main oil-producing fields in the UAE

Field	Discovered	Producing Wells	API Gravity
Abu Dhabi:			
Abu al-Bukhoosh	1969	42	32.0
Asab	1965	106	41.0
Bab	1958	100	44.0
Bu Hasa	1962	201	39.0
Bunduq	1964	23	40.0
Mubarraz	1969	28	37.0
Sahil	1967	22	39.7
Satah	1975	10	39.8
Umm al-Dalkh	1969	32	32.5
Umm Shaif	1958	142	37.0
Lower Zakum	1963	131	39.0
Upper Zakum	1963	142	35.0
Total		979	
Dubai:			
Falah	1972	25.5	
Fateh	1966		31.8
Rashid	1973	141	38.0
Margham	1981	10	43.5
Total		151	
Ra's al-Khaimah:			
Saleh	1983	7	50.0
Sharjah:			
Kahaif	1992	4	50.0
Saja'a/Moyeid	1980	30	50.0
Mubarak	1972	14	47.0
Total		48	

Source: IPE, *MEES***Table 4. Natural gas production 1994–1998 (million cubic metres)**

	1994	1995	1996	1997	1998	98/97 % change
Gross Production	34,360	40,860	45,930	48,090	48,980	1.9
Marketed Production	25,820	31,320	33,800	36,310	37,070	2.1
Flaring	390	360	390	1,520	1,500	-1.3
Reinjection	4,330	6,000	8,510	7,000	7,150	2.1
Shrinkage	3,820	3,180	3,230	3,260	3,260	-

Source: OPEC