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SURVEY AND ASSESSMENT OF ENERGY-RELATED ACTIVITIES IN THE ESCWA REGION, 1990-1991

93-0003

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I. RECENT DEVELOPMENTS IN THE ESCWA REGION OIL INDUSTRY

A. International oil market conditions

The Economic and Social Commission for Western Asia (ESCWA) region is directly affected by international oil market conditions, since the region holds a significant portion of the world's reserves of crude oil and the sale of petroleum and petroleum products accounts for a substantial portion of the region's gross domestic product (GDP). Political developments during 1990 and the ensuing Gulf War caused uncertainty in the international oil market for only a short while. The embargo on oil from Iraq and Kuwait resulted in short-term shortages which were alleviated by increases in output from other major oil producers in the ESCWA region. Oil revenues accrued by major oil producers in the ESCWA region changed dramatically with significant increases in some countries and dramatic decreases in those of Iraq and Kuwait. ESCWA countries with modest reserves, namely Egypt, Oman, the Syrian Arab Republic and the Republic of Yemen, continued their policies of increasing production capacity and output.

1. Oil prices

Oil prices increased sharply in August 1990 due to political developments in the ESCWA region and the ensuing uncertainty in supply perceived by major consuming countries. Prices decreased steadily during the last three months of 1990 when it became apparent that oil supplies would not be seriously disrupted. In the latter half of January 1991, oil prices decreased further after the outbreak of war in the region did not affect oil installations. By February, prices had fallen below early-1990 levels. Table 1 shows oil prices of various types of crude oil on a month-by-month basis during 1990 and 1991. Average prices for 1991 are significantly lower than those of 1990 largely due to the higher prices in the second half of 1990.

Table 1. Selected average oil prices, 1990-1991
(US dollars/barrel)

Month	Arabian Light 1990	Arabian Light 1991	Oman (Blend) 1990	Oman (Blend) 1991	OPEC Basket 1990	OPEC Basket 1991
January	20.13	20.70	20.56	20.20	19.98	22.32
February	18.42	15.31	18.78	14.86	19.03	17.47
March	17.31	15.94	17.68	15.39	17.67	17.19
April	16.87	16.31	17.25	15.78	15.63	17.38
May	16.36	16.59	16.72	16.47	15.47	17.78
June	14.78	16.13	15.15	15.95	14.02	17.22
July	16.85	17.02	17.26	16.77	15.68	18.20
August	27.00	17.38	27.48	17.15	24.86	18.47
September	32.53	18.28	33.09	18.30	32.10	19.19
October	34.90	19.64	35.51	19.40	34.32	20.42
November	30.88	19.03	31.52	18.94	30.78	19.84
December	27.65	16.25	28.21	15.86	20.16	14.39
Average	22.81	17.38	23.27	17.09	21.64	18.32

Source: ESCWA Energy Data Bank and various international sources.

The steady decline in international oil prices during the first half of 1990 was a result of increased output levels by major producers, often above those specified in the Organization of Petroleum Exporting Countries (OPEC) agreement. The low oil prices and adverse effects on oil revenues negatively affected ESCWA oil-producing countries with no excess production, including Iraq. Subsequent oil market conditions have been influenced by the invasion of Kuwait, the resulting embargo on all trade with Iraq, and ultimately the war as well as post-war decisions by the United Nations and major oil producers.

2. World supply of oil

The world oil supply increased somewhat over 1989 levels during the 1990-1991 period despite the interruption of production in Iraq and Kuwait after August 1990. Supply averaged 66.9 and 66.6 million barrels/day (mn b/d) during 1990 and 1991 respectively compared with 66 mn b/d during 1989. The breakdown of supply by producing groups is shown in table 2.

Table 2. World oil supply, 1989-1990
(Million barrels/day)

	1989	1990	1991	Percentage change 1991/1989
OPEC	23.7	25.1	25.3	6.75
OECD	15.9	15.9	16.3	2.52
USSR	12.3	11.5	10.4	-15.45
Other non-OECD	12.8	13.1	13.4	4.69
Processing gain	1.3	1.3	1.3	0.0
Total supply	66.0	66.9	66.6	0.91

Source: OECD Economic Outlook, December 1991 as reported in Middle East Economic Survey, 13 January 1992, p. A5.

Note: Includes natural gas liquids.

An increase in production of 6.8 per cent by OPEC members accounted for some of the overall increase in supply during the 1989-1991 period. With the exception of Iraq and Kuwait, virtually every OPEC member with excess production capacity increased output significantly. Non-OPEC producers with significant increases in production during this period include Norway, Mexico and Oman. These increases were generally offset at the international level by the notable decrease in production of over 15 per cent by the former Soviet Union due to deterioration of production capacity and uncertainties associated with efforts to privatize State-owned industries.

By and large, the increase in world supply occurred during 1990, with 1991 levels changing only slightly. Supply increases, especially during the first half of 1990, accounted for the substantial decreases in international oil prices during that time. After August 1990, the suspension of the sale of

oil from Iraq and Kuwait was offset by increases in production levels from other major oil producers. Output patterns remained the same by the end of 1991 when Iraq had not resumed exporting oil and Kuwait had begun to sell limited quantities only. Iraq refused to accept conditions imposed by the United Nations which would have allowed the sale of oil under strict supervision while Kuwait had not repaired extensive damage to its oil-producing equipment and infrastructure sustained during the Iraqi invasion and the ensuing Gulf War.

World supply decreased by approximately 5 per cent immediately after the Iraqi invasion of Kuwait due to the disruption of supplies from those countries. However, output increased steadily, and by November 1990 world output had surpassed July levels.

Recent forecasts by the International Energy Agency predict that oil supplied by non-OPEC countries will fall by 0.5 mn b/d largely due to expected decreases in supply by the former USSR, which will fall to 9.5 mn b/d in 1992.1/ This follows the trend observed in world oil supply in recent years.

3. World demand for oil

World demand for oil increased slightly during the 1989-1991 period largely due to consumption increases in non-OECD (mainly developing) countries as shown in table 3. Significant increases in demand occurred in OPEC and non-European, non-OECD countries which together accounted for over 28 per cent of total world demand in 1991. This increase is in line with the long-term trend of steady increase in oil demand by developing countries, which is expected to continue. Consumption in the USSR and non-OECD Europe (formerly referred to as the centrally-planned economies) declined sharply during this period as these countries struggled to implement economic reforms. The decline experienced in these countries should be reversed once the transition from centrally planned to more market-oriented systems is completed. Organisation for Economic Cooperation and Development (OECD) consumption remained stable during this period, in part due to recessionary pressures in some of these countries as well as ongoing conservation and environment-related efforts which dampen demand.

Weak demand in the first half of 1991 is thought to have contributed to the relatively low prices during that period. Since major producers, excluding Iraq and Kuwait, are operating at full capacity, changes in demand will have a pronounced effect on world oil prices at least until Iraq and Kuwait begin producing and selling oil on the world market.

World-wide demand for oil in 1992 is expected to increase by less than 1 per cent, with slightly higher increases occurring in OECD and OPEC countries as well as other developing countries, but offset by declines in the former USSR and other non-OECD European countries generally following the trend observed from 1989 to 1991.2/ Oil consumption in the former USSR is expected to fall to 7.7 mn b/d in 1992 and to 1.3 mn b/d in non-OECD European

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1/ Middle East Economic Survey, 20 January 1992, p. A3.

2/ Ibid.

countries.[3/] The International Energy Agency (IEA) expects the growth in oil demand to be strongest in North America where consumption is forecasted to grow by approximately 2.2 per cent over 1991 levels after several years of decline.

Table 3. World demand for oil, 1989-1991
(Mn b/d)

	1989	1990	1991	Percentage change 1991/1989
OECD consumption	37.8	37.9	37.8	0.0
OPEC consumption	4.3	4.4	4.6	7.0
USSR consumption	8.8	8.4	8.2	- 6.8
Non-OECD Europe consumption	1.9	1.7	1.4	-26.3
Other non-OECD consumption	13.1	13.7	14.1	7.6
Total demand	65.9	66.1	66.1	0.2

Source: OECD Economic Outlook, December 1991 as cited in Middle East Economic Survey, 13 January 1992, p. A5.

Notes: Including processing gains, natural gas liquids and, in OECD and OPEC consumption, consumption by marine bunkers. The category "non-OECD Europe consumption" is largely Central and Eastern Europe.

4. Oil stock level

Oil stock levels in OECD countries have increased by 3.4 per cent during the period 1989-1991 period.[4/] Oil stock levels reached 3,600 million barrels at the end of 1991 though the yearly average was 3,524 million barrels. The United States sold oil from its strategic reserves in late 1990 in an effort to counteract sharp price increases resulting from fears of supply disruptions due to the Gulf crisis.

B. Oil-related developments in the ESCWA region

1. ESCWA region oil reserves

ESCWA region oil reserves increased by less than 1 per cent during the period 1989-1990 as shown in table 4. Decreases in reserve levels experienced by some ESCWA countries with relatively low reserve levels are generally the result of depleting reserves. The ESCWA region's reserves, as a percentage of total reserves, also increased only slightly during the period since no significant discoveries were made. The ESCWA region accounts for 57.8 per cent of world reserves, assuring it a prominent role in the international oil market.

3/ Ibid.

4/ Middle East Economic Survey, 17 February 1992, p. A3. Based on OPEC estimates.

2. ESCWA region oil production

Although the ESCWA region's oil production remained relatively stable during the period 1989-1991, recording a decrease of less than 2 per cent, extreme variations occurred on a country-by-country basis as a direct result of the Gulf crisis and ensuing war. Table 5 shows the oil production levels of each oil-producing ESCWA country from 1989 to 1991 as well as total production by the ESCWA region and its proportion of world production and OPEC production.

Table 4. ESCWA region oil reserves, 1989-1991
(Mn barrels)

	1989	1990	1991	Percentage change 1991/1989
Bahrain	112	97	84	-25.5
Egypt	4 500	4 500	4 500	0.0
Iraq	100 000	100 000	100 000	0.0
Jordan	10	20	5	-50.0
Kuwait	97 125	97 025	96 500	-0.6
Oman	4 250	4 300	4 250	0.0
Qatar	4 500	4 500	3 729	-17.1
Saudi Arabia	256 209	260 004	260 342	1.6
Syrian Arab Republic	1 700	1 700	1 700	0.0
United Arab Emirates	98 105	98 100	98 100	-1.0
Republic of Yemen[a/]	4 000	4 000	4 000	0.0
Total ESCWA	570 511	574 246	573 210	0.5
ESCWA/World (percentage)		57.0	57.5	57.8

Source: ESCWA Energy Data Bank and Oil and Gas Journal, various issues.

a/ The former Democratic Yemen and Yemen united in 1990. 1989 data for Yemen are the combined reserves of both countries.

Table 5 shows the extreme decreases in production by Iraq and Kuwait during the period immediately after the Iraqi invasion of Kuwait in August 1990. United Nations sanctions imposed soon after the invasion prevented the sale of oil from either country on international oil markets. By the end of 1991, the trade embargo on Iraq had not ended, but Kuwait had begun exporting crude oil and had made efforts at restoring its productive capacity and ability to export.

Table 5 also shows significant increases in output by Oman, Saudi Arabia, the Syrian Arab Republic, the United Arab Emirates and the Republic of Yemen. While these increases occurred largely as a response to the cessation of sales

from Iraq and Kuwait after August 1990, output from some countries had begun to increase during the first half of 1990. Production levels during the first seven months of 1990 averaged 1,956,000 b/d, 5,606,000 b/d, and 2,063,000 b/d in Kuwait, Saudi Arabia, and the United Arab Emirates, respectively. These levels represented an increase exceeding 9 per cent over 1989 average production levels in each country. During the last five months of 1990, Saudi Arabia and the United Arab Emirates further increased their output which averaged 7,622,000 b/d and 2,196,000 b/d respectively. By December 1990, production in Saudi Arabia had surpassed 8.6 mn b/d, and in the United Arab Emirates it had surpassed 2.4 mn b/d.[5/]

Table 5. ESCWA region oil production, 1989-1990
(Thousands of barrels/day)

	1989	1990	1991	Percentage change 1991/1989
Bahrain	42	42	38	-9.5
Egypt	854	875	885	3.6
Iraq	2 830	2 083	280	-90.1
Kuwait	1 741	1 080	191	-89.0
Oman	623	658	705	13.2
Qatar	395	387	390	-1.2
Saudi Arabia	5 134	6 215	8 223	60.2
Syrian Arab Republic	385	385	473	22.9
United Arab Emirates	1 845	2 101	2 405	30.4
Republic of Yemen	177	179	201	13.7
ESCWA total	14 025	14 003	13 791	-1.7
ESCWA/OPEC[a/] (percentage)	61.9	58.7	59.1	
ESCWA/world (percentage)	22.5	23.1	23.0	

Source: ESCWA Energy Data Bank and international sources.

Notes: Including condensates.

a/ ESCWA/OPEC refers to all ESCWA countries including non-OPEC members.

OPEC met in July 1990 in an effort to solve problems associated with increasing output levels. New quotas were agreed upon, but the agreement was suspended in August when the Gulf crisis abruptly cut the supply available on international oil markets. Table 6 shows OPEC quotas during the period 1989-1991.

5/ Petroleum Economist, January 1992, p. 42 and United States Department of Energy, Energy Information Agency, International Petroleum Statistics Report, February 1992.

Table 6. OPEC quotas affecting the ESCWA region, 1989-1990
(Thousands of barrels)

	Iraq	Kuwait	Qatar	Saudi Arabia	United Arab Emirates	ESCWA Total	OPEC Total	ESCWA/ OPEC[a/]
Jan.-Sept. 1989	2 640	1 037	312	4 524	988	9 501	18 500	51.4
Oct.-Dec. 1989	2 926	1 149	346	5 014	1 094	10 529	20 500	51.4
Jan.-July 1990	3 140	1 500	371	5 380	1 095	11 486	22 086	52.0
July 1990	3 140	1 500	371	5 380	1 500	11 891	22 491	52.9
March 1991	b/	b/	399	8 034	2 320	10 753	22 298	48.2

Source: ESCWA Energy Data Bank and international sources.

a/ ESCWA members of OPEC only; this data is expressed in percentage terms.

b/ Iraq and Kuwait were not included in the March 1991 quotas.

Table 6 shows that the ESCWA-member share of OPEC quotas increased slightly from 1989 to 1990, largely due to increases in the shares of Kuwait, Saudi Arabia and the United Arab Emirates. The July 1990 quotas were suspended after August 1990, and output increases by OPEC members Saudi Arabia, the United Arab Emirates and Venezuela largely replaced the embargoed oil of Iraq and Kuwait. March 1991 quotas were based on the cessation of sales from Iraq and Kuwait and allowed for substantial increases by those OPEC members with the capacity to increase production. March 1991 quotas were established in an effort to limit output and maintain higher prices. The ability of OPEC to control prices by limiting output is uncertain given the over-the-quota production by many members in the past few years and the considerable investment in increased production capacity already made by many OPEC members. Once Kuwait's exports have resumed to pre-invasion levels and Iraq begins exporting oil, the commitment to price maintenance on the part of OPEC members will be tested.

3. ESCWA region production capacity

An important ramification of the Gulf crisis and war was the immediate and sustained use of excess capacity world-wide to produce additional oil. With the interruption of supplies from Iraq and Kuwait, the remaining OPEC countries operated with virtually no excess capacity after late 1990.

At the outbreak of the Gulf crisis, Saudi Arabia and the United Arab Emirates had considerable excess production capacity. Though some doubted

their ability to maintain higher production levels over an extended period of time due to concerns about the condition of mothballed wells and equipment as well as about the effects of sudden increases in production on reservoirs,[6] they were able to increase production rapidly and maintain the higher production levels.[7] Prior to the Gulf crisis and ensuing war, Saudi Arabia and the United Arab Emirates, along with other ESCWA countries, had planned on increasing production capacity to meet expected increases in demand for regional oil in the latter part of the nineties, and production capacity did increase in 1990 in some ESCWA countries, as shown in table 7. These plans are under implementation in Saudi Arabia, which expects to increase its capacity from 8.5 mn b/d to 10 mn b/d at a cost of $US 15 billion. The United Arab Emirates has plans to increase production capacity from the current 2.4 mn b/d to 3 mn b/d by 1995.[8] Table 7 shows expected changes in the production capacity of major ESCWA region oil producers by 1995.

Table 7. Actual and expected production capacity 1989-1995, selected ESCWA countries
(Thousands of barrels/day)

	1989	1990	1995	Percentage change 1995/1989
Iraq[a/]	3 500	300	3 500	0.0
Kuwait	2 500	50	2 800	12.0
Qatar	600	600	650	8.3
Saudi Arabia	7 800	8 525	10 300	32.1
United Arab Emirates	2 210	2 400	3 000	35.8

Source: "The Post-Crisis Outlook of the World Oil Market" The NCB Economist, October 1991, table 2.

Notes: Figures for Kuwait and Saudi Arabia include the Neutral Zone. End of year figures.

a/ In December, 1991 Iraq announced plans to increase capacity to 6 mn b/d by the year 2000.

6/ "World-wide Production Report", Oil and Gas Journal, 30 December 1991, pp. 43-47.

7/ For an interesting account of how Saudi Arabia quickly increased its production see "Saudi Aramco Describes Crisis Oil Flow Hike", Oil and Gas Journal, 2 December 1991, pp. 49-52.

8/ "The Post-Crisis Outlook of the World Oil Market", The NCB Economist, October 1991, p. 5.

These planned increases in production capacity are in line with trends observed in most major oil-producing countries. Previous OPEC quota decisions based in part on production capacity as opposed to reserves only, as well as expectations of increased demand for OPEC oil, have provided incentive for many OPEC members to invest in additional capacity. Recent financial commitments by some OPEC countries and the rather weak financial long-term position of other OPEC countries have led to speculation about ways and means of financing the planned increase in production capacity. International oil companies, many of which are now in strong financial positions, may be called upon to aid in the financing of such ventures in some oil-producing countries including those in the ESCWA region.9/

One of the most serious effects of the Gulf crisis and the ensuing war was the damage sustained to the production capacities of Iraq and Kuwait. The damage to Kuwait's oil-producing infrastructure was considerable and included the oil wells set afire by retreating Iraqi forces in February 1991. All fires were extinguished by November 1991, though considerable expense was incurred financially and environmentally. Serious damage was also incurred on storage tanks, pipelines and offloading facilities and crude export facilities.10/ Furthermore, many of the staff involved in crude oil production left the country, creating a shortage of qualified staff during most of 1991. Petroleum product transport facilities were also destroyed. Less than 10 per cent of the original refinery personnel were in Kuwait by June 1991.11/ Kuwait was, however, able to resume crude oil exports by the end of 1991 when production reached 500,000 b/d.12/ By early 1992 Kuwait planned to gradually increase production in 50,000-b/d increments and hopes to reach 1.5 mn b/d by the end of 1992. Kuwait also hopes to restore production capacity to 2 mn b/d, close to its pre-invasion capacity, by late 1993.13/

During the war, Iraq sustained damage to port facilities and to refineries. Iraq was unable to use its pipeline facilities through Gulf countries. Efforts at repairing damaged facilities began soon after the war's end and continued throughout the year. However, the embargo, which continued throughout 1991, was the major impediment to production and export of Iraqi oil. During 1991, the United Nations agreed to a limited amount of supervised oil exports to finance food and medicine imports to Iraq as well as war reparations, but Iraq did not agree to the terms and very little oil was exported. Iraq's 1990 production capacity noted in table 7 reflects the conditions imposed by the United Nations sanctions rather than that of physical limitations on exports.

9/ For more details about possible arrangements, see Middle East Economic Digest, 18 October 1991, pp. 4-5.

10/ Middle East Economic Survey, 24 June 1991, pp. D1-D8; United Nations report on overall damage in Kuwait.

11/ Ibid.

12/ Middle East Economic Survey, 13 January 1992, pp. A10-A11.

13/ Ibid.

4. ESCWA region oil revenues

While ESCWA region oil revenues as a whole increased by approximately 8.4 per cent during the period 1989-1991, wide differences occurred on a country-by-country basis as shown in table 8. These differences are a result of the wide variation in output levels occurring after the embargo on Iraqi oil in 1990 and the disruption of Kuwait's oil exports.

ESCWA region oil revenues were also affected by changes in prices during the period 1989-1991 which were especially significant during 1990. With the exception of Bahrain, Iraq and Kuwait, revenues of individual ESCWA countries increased significantly due to the simultaneous increase in world oil prices and production in these countries. The oil revenues of Saudi Arabia almost doubled. However, in some ESCWA countries, financial obligations rose in connection with the Gulf crisis and ensuing war, offsetting revenue gains. The substantial decline in revenues experienced by Iraq and Kuwait have had severe adverse effects on their economies. Kuwait has relied on earnings from foreign investments and has liquidated some of its investment portfolio to pay foreign obligations associated with the war and subsequent rebuilding activities. Iraq has experienced a severe contraction in its economic activities and exorbitant inflation rates which have adversely affected living standards.

Table 8. ESCWA region estimated oil revenue, 1989-1991
(Millions of US dollars)

	1989	1990	1991*	Percentage change 1991/1989
Bahrain*	267	332	254	-4.9
Egypt	1 019	1 396	1 200	17.8
Iraq	14 500	9 463	0	-100.0
Kuwait	9 306	5 536	978	-89.5
Oman	3 659	5 023	4 714	28.8
Qatar	1 955	2 800	2 255	15.4
Saudi Arabia	24 093	39 700	47 500	97.2
Syrian Arab Republic	2 289	3 034	3 163	38.2
United Arab Emirates	11 500	15 000	14 190	23.4
Republic of Yemen*	1 123	1 414	1 344	19.7
Total ESCWA	69 711	83 698	75 598	8.4

Source: ESCWA Energy Data Bank and various international sources including OPEC Annual Statistical Bulletin, various issues.

Notes: Revenues are based on exported oil. An asterisk denotes ESCWA estimate.

C. The ESCWA region refining industry

During 1990 and 1991, the ESCWA region's refineries increased in total number and in capacity. Table 9 shows the number of refineries and total

capacity for each ESCWA country from 1 January 1990 to 1 January 1992. While only one additional refinery came on line during this period, three other ESCWA countries expanded the total capacity of existing facilities. Only Qatar and Yemen experienced a drop in refinery capacity over the two-year period. Total ESCWA refining capacity increased by 23 per cent from 3.7 mn b/d to 4.6 mn b/d.

The Gulf War resulted in damage to the refinery installations of Kuwait and Iraq. Part of the damage to Kuwait's refineries was incurred during the rapid shut-down of operations on 2 August 1990 and to the fact that most of the facilities were idle during the occupation and the war. Kuwait suffered extensive damage to the Mina Abdullah refinery and some damage to the Mina al-Ahmadi refinery, both of which made petroleum products for local consumption as well as for export and represent 70 per cent of Kuwait's total refining capacity.14/ Damage was also sustained by the refinery at Mina Shuaiba, and the Mina Al Zour refinery was destroyed. In addition, storage facilities and pipelines were damaged or destroyed. Immediately after the end of the hostilities, Kuwait imported petroleum products for domestic use. By December 1991, however, enough repairs had been completed to allow both refineries to operate at below-capacity levels. Domestic needs were being met, and 120,000 b/d of kerosene and gas oil were available for export.15/ Officials announced in 1992 that repairs would be completed by 1995.

By April 1990, Iraq's Baiji refinery had begun operations after a three-month shut-down.16/ Iraq also was able to resume operations at its damaged Daura and Baiji refineries in mid-1991 to meet domestic demand. Refinery facilities in Khafji were also damaged as a result of the hostilities. By July 1991, the Nasiriya refinery was producing 10,000 b/d of refined products for local consumption.17/

In spite of the uncertainties caused by the Gulf War, the refining industry world-wide began a rebound following a 15-year slump in which many refineries were closed and the entire industry was restructured. Oil-exporting countries of Western Asia, notably Kuwait, Saudi Arabia and the United Arab Emirates, participated in this process by purchasing downstream facilities near consumer markets in Europe, North America and Asia. The world-wide market and prospects for profits for refined products are expected to improve due to the decrease in facilities as well as the modest rise forecasted in demand. As a result of this and of new environmental regulations in major consuming countries, expansion plans are under way in many countries, including those in the ESCWA region.

14/ For a detailed assessment of the damage to Kuwait's refining industry, see Report to the Secretary-General Assessing the Scope and Nature of Damage Inflicted on Kuwaiti's Infrastructure during the Iraqi Occupation, (S/22535), United Nations, New York, 1991.

15/ Arab Oil and Gas, vol. 21, No. 488, 16 January 1992, p. 12.

16/ Oil and Gas Journal, 22 April 1991, p. 33.

17/ Petroleum Economist, July 1991, p. 29.

Table 9. Number of refineries and refinery capacity in the ESCWA region, 1990-1992

Country	1990		1992	
	No.	Capacity (b/d)	No.	Capacity (b/d)
Bahrain	1	243 000	1	243 000
Egypt	8	489 203	8	523 153
Iraq	8	318 500	8	318 500
Jordan	1	100 000	1	100 000
Kuwait	4	819 000	4	819 000
Lebanon	2	37 000	2	37 500
Oman	1	76 932	1	80 000
Qatar	1	62 000	1	60 000
Saudi Arabia	7	1 007 000	8	1 862 500
Syrian Arab Republic	2	234 744	2	237 394
United Arab Emirates	2	180 000	2	192 500
Republic of Yemen	2	171 500	2	114 500
Total ESCWA	39	3 738 879	40	4 588 047

Source: International Petroleum Encyclopedia, various issues.

Notes: Capacity refers to barrels per day of crude oil. All figures are as of 1 January of the stated year.

Bahrain announced in early 1992 that it would upgrade its current facility by building a 180,000 b/d oil-refining unit.[18/] Its refinery, located in Sitra, was built in 1936 and has been operating at 95 per cent capacity in recent years. Egypt is in the process of expanding the recently-built Assiut refinery as indicated in table 10. Saudi Arabia has undertaken an extensive upgrading and expansion programme designed to modernize its facilities and allow them to create products in line with international and domestic demand. This programme is expected to take 10 years and cost an estimated $US 1.5 billion.[19/] The United Arab Emirates is also undertaking the construction of a new refinery in Jebel Ali which will have a capacity of 150,000 b/d. The Jebel Ali Refinery Company, owned by the Government of Dubai, will own and operate the new facility.[20/] The United Arab Emirates has also undertaken the expansion of its two refineries. In

18/ Jordan Times, 27 May 1992, p. 7.

19/ Middle East Economic Digest, 5 April 1991, pp. 14-17. For a thorough review of Saudi Arabia's refining industry, see The NCB Economist, "The Saudi Oil Refining Sector", vol. 2, No. 5, May/June 1992.

20/ Petroleum Economist, June 1981, p. 32.

addition, the Republic of Yemen is investigating the possibility of modernizing and upgrading its Aden refinery.[21/] The Republic of Yemen makes refined products for domestic use in its Marib Refinery. Table 10 details expected expansions to ESCWA region refinery capacity.

Table 10. Refinery expansion and construction plans in the ESCWA region

Country/site	Current capacity (b/d)	Planned capacity (b/d)	Planned capacity (b/d)	Probable date of completion
Egypt/Assiut	50 000	50 000	100 000	1992
Iraq/Baghdad*		140 000	140 000	1992
/Mussayib*		140 000	140 000	1993
Saudi Arabia				
/Jeddah	90 000	20 000	110 000	1995
/Ras Tanura	300 000	700 000	1 000 000	2000
/Riyadh	135 000	15 000	150 000	1995
/Yanbu (SAMAREC)	170 000	70 000	240 000	1995
/Yanbu (Petromin and Mobil)	280 000	70 000	350 000	2000
United Arab Emirates/Ruwais	120 000	160 000	280 000	1992
/Umm Al Nar	60 000	12 500	72 500	1992
/Jebel Ali*		150 000	150 000	1996

Sources: The NCB Economist, National Commercial Bank, Jeddah, vol. 2, No. 5, May/June 1992; Petroleum Economist, September 1991, pp. 10-13; Jordan Times, 27 May 1992, p. 7.

Note: Yanbu, Saudi Arabia has two refineries; one owned by the Saudi Arabian Marketing and Refining Corporation (SAMAREC) and the other owned by Petromin and Mobil.

* New facilities.

Recent environmental regulations in many developed countries have led to expectations of a surge in demand for methyl tertiary butyl ether (MTBE). MTBE is an oxygenate which is added to gasoline to enhance its octane level and enable refiners to reduce its lead content. The use of MTBE world-wide is expected to grow from approximately 260,000 b/d in 1991 to 677,000 b/d in 1995.[22/] Refineries in Western Asia are expected to provide at least some of the additional MTBE demanded during this decade. Currently, Saudi Arabia

21/ Petroleum Economist, October 1991, p. 30.

22/ International Petroleum Encyclopedia, (Tulsa, OK: Penwell Publishing), 1992, p. 320.

has an MTBE plant in Ibn Zahr which can produce 500,000 tons each year.23/ Saudi Arabia has two additional facilities under construction which will together produce 1.4 million tons of MTBE annually. Also, plans for three other MTBE plants in Saudi Arabia are under consideration. Feasibility studies for MTBE plants in Bahrain and the United Arab Emirates are currently under way, and Qatar is awaiting financing for an MTBE plant with a planned capacity of 550,000 tons and an estimated cost of $US 600 million.

D. Developments related to oil and the environment

One of the most serious ramifications of the Gulf War in 1991 was the ensuing environmental degradation that affected most of the Gulf region, especially Kuwait. The Gulf War ended with burning oil wells causing harmful air pollution which darkened the skies of Kuwait and the surrounding area during much of the rest of the year. Gushing oil wells also flowed freely with large pools of oil forming on the desert surface. During the war, oil was also allowed to flow into the Arabian Gulf, causing a large oil slick.

The wells on fire at the end of the Gulf War in 1991 were extinguished by early November of the same year at a cost of $US 1.5 billion.24/ Experts estimate that 1 to 1.5 per cent of Kuwait's oil reserves burned during this time at a rate of 6 mn b/d. The burning oil caused noxious fumes over much of the country as well as in Iraq, Saudi Arabia, and other Gulf countries.25/ Oil mist and dust particles reached as far as India. Adverse effects on wildlife, domestic animals, and plant life were noted. The gushing wells, which did not ignite properly, caused severe ecological damage to the desert surface, and, though the wells have been capped, the oil pools remain.

Estimates of the exact amount of oil spilled into the Persian Gulf during the war vary considerably, but by May 1991 almost 80 million gallons had been pumped out of the water at Dhahran and Jubail. The large oil slick affected water quality and coastal areas in Saudi Arabia, Bahrain and Qatar as well as Kuwait. Sea and animal life, including birds, have been severely affected. Because of the delicate ecological balance originally existing in the Persian Gulf and the long time it takes for the body of water to completely recycle, the effects of the spill are expected to be long-lasting.

The ESCWA region also experiences other pollution from the normal consumption of oil. The most serious situation with regard to air pollution is found in Cairo, Egypt. Officials are combating this problem, in part, by encouraging industry to locate in specified industrial areas outside Cairo. This will alleviate pollution from exhaust fumes as well as industrial pollution since much of the pollution is caused by heavy commuter traffic. Recent public dissatisfaction with the problem has prompted the Government to establish a special agency to deal with matters related to environmental quality in Egypt.

23/ Middle East Economic Digest, 7 February 1992, p. 5.

24/ Petroleum Economist, April 1992, p. 28.

25/ For a comprehensive analysis of the effects of the oil fires, see Farouk El-Baz, "Preliminary Observations of Environmental Damage due to the Gulf War", Natural Resources Forum, vol. 16, No. 1, February, 1992, pp. 71-75.

II. RECENT DEVELOPMENTS IN THE ESCWA REGION GAS INDUSTRY

A. The ESCWA region and the international gas market

The ESCWA region holds 17 per cent of the world's natural gas reserves, rendering it a potential contributor to the steadily-growing international gas market. Interregional and intraregional trade in gas and related products remained minimal during the period 1989-1991, with the only instance of natural gas trade within the region halted due to the Gulf War. Liquified natural gas (LNG), however, continued to be exported from the United Arab Emirates to Japan. The region's reserves increased only slightly during the 1989-1991 period compared to a world-wide increase of over 6 per cent. Marketed production of natural gas has increased steadily during the past decade as ESCWA countries have undertaken efforts to further reduce flaring and have encouraged the domestic use of gas to replace petroleum and petroleum products.

The period 1989-1991 witnessed a continuation of the trend toward increasing the domestic utilization of gas in many ESCWA countries. The encouragement of domestic natural gas use has become the policy of many ESCWA countries holding natural gas reserves as a means to reduce consumption of petroleum and petroleum products. This policy is designed to allow more petroleum for export in countries such as Egypt and the Syrian Arab Republic or to reduce drains on hard currency in oil-importing countries such as Jordan. Major oil-exporting countries have invested heavily in gas-utilizing industries to best utilize total energy resources.

The Gulf crisis and ensuing war disrupted gas production in Iraq and Kuwait but had little effect in the rest of the region. Gas-processing facilities were damaged in both Iraq and Kuwait, and efforts have been directed at restoring these facilities. Iraq has been particularly successful in restoring pre-war production and processing capacity. Kuwait's reserves are largely associated (in the same well as oil) and the resumption of gas production has been linked to oil production capacity. The Gulf crisis and war created an air of uncertainty which resulted in the postponement of investment and exploration activities in other ESCWA countries, especially Gulf Cooperation Council (GCC) countries. However, since the end of the war, exploration activities have resumed with significant gas discoveries found in Egypt, Oman, the United Arab Emirates and the Republic of Yemen. Also, the implementation of various investment plans to exploit natural gas reserves has resumed.

The demand for natural gas is growing world-wide partly because of increases in demand resulting from the general concern over environmental issues. Gas is the cleanest-burning fossil fuel, and many Governments are encouraging its use over other fuels. Growing recognition of environmental problems may further encourage ESCWA region countries to use natural gas domestically. Natural gas is currently used in the household and industry sectors and for the production of electricity within the region.

Many ESCWA countries have reserves in excess of their domestic needs. Intraregional trade of natural gas occurred on a limited basis prior to the

Gulf War, and potential for increasing trade exists within the region. The Syrian Arab Republic, Iraq, the United Arab Emirates, Qatar and Oman now have the resources to supply nearby countries with gas if investment in recovery and transport facilities is undertaken.

Environmental considerations may also affect future demand for ESCWA-region gas from other regions. The Far East has been a market for ESCWA-region LNG, and Japan has expressed interest in purchasing gas from Qatar and Oman. Its demand for LNG is expected to increase from 42 billion cubic metres per year (cu m/y) in 1989 to 50-60 billion cu m/y in the year 2000.[26/] Other potential customers include India and Pakistan. Europe has also been considered as a potential market for ESCWA-region gas. Demand for gas is increasing in Europe due in large part to concerns about the quality of the environment. Currently, EEC countries import gas from Norway, Russia, the Libyan Arab Jamahariya and Algeria. As consumption increases, and if other suppliers cannot meet its needs, Europe may turn to the ESCWA region for additional supplies. Also, energy shortages as well as growing concerns in Eastern Europe and the former Soviet Union over the condition of the environment may cause some of those countries to purchase gas from international markets. World demand for LNG is expected to grow by 50 per cent during the nineties to reach 90 billion cu m/y by the year 2000 and should be 120 billion cu m/y by 2010.[27/] Further opportunities may exist for ESCWA countries to market gas in other regions as the international gas market grows.

B. ESCWA region natural gas reserves

Proven gas reserves in the ESCWA region declined slightly during the 1989-1991 period, as shown in table 11, mainly due to declines in some member countries. The ESCWA region's share of total world reserves of gas also fell from 19 per cent in 1989 to 17 per cent in 1991, largely as a result of increases in proven reserves elsewhere in the world. This figure was only 16 per cent in 1987. While the ESCWA region's importance in the gas market is not of the same magnitude as in the international oil market, these figures show that gas is important as a domestic energy source in the region and that the ESCWA region has the potential to become an important exporting region in an integrated international gas market.

Most gas produced in the ESCWA region is consumed in the country of production. Recent gas discoveries in Egypt, Jordan and the Syrian Arab Republic have been exploited quickly for domestic use, and plans for domestic use of gas in Yemen are also under consideration. These countries are following a strategy of replacing domestic oil consumption with gas when possible to allow for increases in oil exports or, in the case of Jordan, decreases in oil imports. Oman has also discovered significant gas reserves recently and has developed plans to utilize it.

26/ G. Vernon Hugh, "LNG -- Continued Market Expansion", Petroleum Economist, Dec. 1989, pp 367-369.

27/ Ibid., p. 369.

Table 11. Natural gas reserves in the ESCWA region, 1989-1991
(Billions of cubic metres)

Country	1989	1990	1991	Percentage change 1990-1991	Percentage change 1989-1991
Bahrain	183	177	170	-3.85	-7.00
Egypt	332	351	351	0.04	5.76
Iraq	2 690	2 690	2 690	0.00	0.00
Jordan	28	11	3	75.00	-89.89
Kuwait	1 546	1 518	1 373	-9.53	-11.17
Oman	262	204	280	37.42	7.00
Qatar	4 618	4 621	4 587	-0.73	-0.66
Saudi Arabia	5 305	5 249	5 226	-0.44	60.38
Syrian Arab Republic	113	156	181	16.17	-0.75
United Arab Emirates	5 686	5 555	5 644	1.59	-0.75
Yemen	156	198	198	0.00	27.06
Total ESCWA	20 919	20 730	20 704	-0.13	-1.03
Total world	112 003	119 400	123 973	3.83	10.69
ESCWA/world (percentage)	19	17	17		

Source: Oil and Gas Journal, various issues.

C. ESCWA region gas production and consumption

Gas-producing countries in the ESCWA region have made considerable efforts during the past decade to reduce flaring and losses of natural gas. Petrochemical, fertilizer and other industries were developed to utilize associated and non-associated reserves of natural gas. The GCC area now boasts a modern, competitive petrochemical industry which competes successfully world-wide and uses natural gas as a feedstock. Other ESCWA countries have encouraged the domestic use of natural gas as a substitute for petroleum and petroleum products. Gas is increasingly used by households throughout the region for domestic activities. In addition, natural gas is used to produce electricity in many countries of the region.

Marketed production of natural gas in Bahrain declined slightly in 1990. Bahrain's reserves are limited, and currently it is actively exploring for hydrocarbon resources and hopes to find gas. Seismic surveys and exploration wells have been undertaken offshore but reserves have not yet been located.28/

28/ Arab Oil and Gas, vol. 21, No. 491, 1 March 1992, p. 22. and Arab Oil and Gas, vol. 21, No. 493, 1 April 1992, p. 21-22.

Egypt is actively pursuing a policy of substituting oil and petroleum products with natural gas for domestic consumption. Marketed production increased during 1990 by almost 5 per cent as shown in table 12. During 1991, further increases in marketed production occurred, resulting in a total of 9,240 million cubic metres.[29/] This represents an increase of more than 14 per cent over the 1990 level. Plans to develop recent gas discoveries include a gas pipeline from offshore reserves. Egypt is also planning to expand the gas distribution network in Cairo and is undertaking work on another gas system which will gather gas from the Gulf of Suez and the Sinai and add 10 per cent to total gas production.[30/]

Efforts have also been made to encourage greater efficiency in consumption of energy products including gas. During 1991, Egypt raised the price of natural gas to reflect the opportunity cost of energy on the international markets and will gradually raise the price of other energy products in an effort to curb consumption.[31/]

The Gulf War seriously disrupted oil and gas production in Iraq. Prior to the crisis, Iraq produced mostly associated gas for domestic consumption. Some gas was exported to Kuwait. The Gulf War damaged some production and processing facilities. Recently, officials announced that gas production is 45 per cent of the pre-war level.[32/] Iraq has been producing associated gas from northern fields and pumping the surplus oil back into the ground. Gas is used for electricity generation, domestic cooking and heating.

Currently, natural gas is used in Jordan for fueling an electric generation plant, and work is currently under way to expand its capacity. It was announced in 1991 that using natural gas for electricity generation has saved $20 million in fuel oil bills.[33/] Jordan is continuing its efforts in exploration for natural gas, and a study is under way to identify ways and means of furthering its utilization of existing resources near the Iraqi border.

The occupation of Kuwait by Iraq in 1990 and the ensuing Gulf War halted the production of gas during the second half of 1990 and 1991. Kuwait's gas reserves are mostly in the form of associated gas, and production levels are usually related to oil production. Kuwait's four gas booster stations were damaged or destroyed during the war and, after the war, gas burned along with the burning oil wells or escaped from gushing wells. The liquified petroleum gas (LPG) plant, however, was not damaged, and enough repairs were made to terminal facilities to allow exports of butane and propane to Japan in early 1992.[34/] During 1991, Kuwait imported gas for domestic use.[35/]

29/ Arab Oil and Gas, vol 21, No. 492, 16 March 1992, p. 34.
30/ Arab Oil and Gas, 16 September 1991, p. 12.
31/ Arab Oil and Gas, 1 September 1991, p. 41.
32/ Jordan Times, 9 June 1992, p. 7.
33/ Jordan Times, 12 August 1991, p. 1.
34/ Arab Oil and Gas, vol. 21, No. 493, 1 April 1992, p. 8.
35/ Middle East Economic Survey, 24 June 1991, p. D5.

Table 12. Marketed production of natural gas in the ESCWA region, 1989-1990
(Millions of cubic metres)

Country	1989	1990	Percentage change 1989-1990
Bahrain	5 730	6 170	7.68
Egypt	7 740	8 110	4.78
Iraq	6 450	4 180	-35.19
Jordan	54	156	188.89
Kuwait	8 160	5 230	-35.91
Oman	2 790	2 800	0.36
Qatar	6 200	6 720	8.39
Saudi Arabia	29 800	30 500	2.35
Syrian Arab Republic	1 040	1 070	2.88
United Arab Emirates	22 380	22 100	-1.25
Total ESCWA	90 344	87 036	-3.66
Total world	2 039 782	2 071 025	1.53
ESCWA/world (percentage)	4.4	4.1	

Source: ESCWA, based on various national and international sources.

The first phase of the North Field project, designed to exploit significant gas reserves in Qatar, was inaugurated in September 1991 with the bulk of the approximately 20 million cu m/day of gas produced used domestically.[36/] Fifty thousand barrels/day of natural gas liquids (NGL) are also produced for export. Phase II of the project, which will be export-oriented, is proceeding with efforts currently aimed at obtaining markets and financing. The design and construction of a new terminal at Ras Laffan is under way, and a letter of intent has been signed to export LNG from Ras Laffan to Japan in 1997.[37/] As noted earlier, Qatar also has plans to build a refinery which will produce MTBE and methane using natural gas as a feedstock. Other plans include exporting gas to neighbouring countries and a possible scheme to supply Pakistan with gas via a proposed pipeline.

The Syrian Arab Republic is initiating a $US 300-million gas-gathering project in its non-associated gas fields in the Palmyra region.[38/] The Syrian Arab Republic is also in the process of commissioning a comprehensive study on natural gas utilization. In late 1991, a gas-processing plant with a capacity of over 4 million cubic metres/day was opened at the Omar field using associated gas from nearby oil fields.[39/] Two other gas-processing plants at Suwaidiyah and Jbaisseh are in operation with a total capacity of almost 2.4 million cu m/day. In early 1992, the Syrian Arab Republic initiated work on an electric generation plant designed to utilize natural gas.[40/] During 1991, the possibility of the Syrian Arab Republic's exporting natural gas from

36/ Arab Oil and Gas, 16 September 1991, p. 5.
37/ Ibid.
38/ Middle East Economic Survey, 16 December 1991, p. A9.
39/ Arab Oil and Gas, 16 December 1991, p. 19.
40/ Middle East Economic Digest, 31 January 1992, p. 29.

a field close to the Turkish border was discussed, and a Turkish company indicated its willingness to build a gasline to facilitate the transaction.[41] The Syrian Arab Republic is also considering the exportation of natural gas to Lebanon.

Recent discoveries in Oman have resulted in an upward revision of total reserves in 1992 to over 400 billion cubic metres.[42] At present, Oman utilizes gas domestically for re-injection into oil fields, fueling electricity generation and desalination plants and other industrial uses. Plans are under way to increase domestic use of gas as well as to invest in downstream industries using natural gas as a feedstock and other export schemes. Although an earlier plan to set up a floating methanol plant has been shelved, a considerable investment of $US 9 billion for an LNG plant was recently announced.[43] Recent forecasts estimate that, at planned production levels, Oman holds enough reserves to export for 20 years and to satisfy domestic needs for 50 years.

Saudi Arabia increased its gas output somewhat in 1990, as shown in table 12, and preliminary figures show that marketed production increased to 32 billion cubic metres or by almost 5 per cent in 1991.[44] Saudi Arabia is undertaking various projects to expand its petrochemical industry which utilizes natural gas. New facilities under construction and in earlier planning stages include those designed to meet the expected increases in demand for MTBE in export markets during this decade. Additional developments include four contracts signed in late 1991 to provide LPG to customers in Japan, South Korea and the United States.[45] Saudi Arabia's exports of LPG to Japan increased from 5.7 million tons in 1989 to over 6.7 million tons in 1990.[46] Additional agreements with other Japanese companies are under discussion.

The United Arab Emirates increased its exports of LNG to Japan from 3,200 cubic metres in 1990 to 3,500 cubic metres in 1991 or by over 9 per cent.[47] Overall marketed production of natural gas in Abu Dhabi increased by almost 12 per cent in 1991.[48] Plans exist to significantly increase gas production including doubling onshore natural gas production in Abu Dhabi during the next

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41/ Arab Oil and Gas, 1 October 1991, p. 20.

42/ Arab Oil and Gas, vol. 21, No. 490, 16 February 1992, p. 19.

43/ Middle East Economic Digest, 21 February 1992, p. 17.

44/ Oil and Gas Journal, vol. 21, No. 492, 16 March 1992, p. 32, citing figures supplied by Cedigaz.

45/ Middle East Economic Survey, 16 December 1991, p. A6.

46/ Arab Oil and Gas, 1 January 1992, p. 13.

47/ Middle East Economic Digest, 21 February 1992, p. 17.

48/ Arab Oil and Gas, vol. 21, No. 492, 16 March 1992, p. 33.

two years. The additional gas will be sent to a planned gas-processing plant at Habshan and used at the Das Island LNG plant which will be expanded. Pipelines will also be constructed. Other plans include an MTBE plant in Dubai's Jebel Ali free zone, as noted earlier, and the construction of a pipeline to further increase the utilization of gas for electricity generation at the free zone by 67 per cent.

Although Yemen has yet to produce gas for domestic use, it commissioned two studies during 1991 to assess the potential for developing gas in the Marib Jawf area for domestic use and export.[49/] Rising gas/oil ratios in the Marib oil fields has caused a slow-down of oil production to avoid the necessity of flaring gas until plans to process the gas are implemented. An earlier study by a Dutch firm recommended that the gas should be used to produce LPG and LNG. The project would cost $US 1.2 billion which would have to be borrowed from the World Bank and private sources. A gas-recycling unit is currently under construction on the Assal-al-Kamil field. Its capacity will be approximately 11 million cu m/day, and it is expected to be completed by 1994. Yemen is committed to developing its gas reserves for domestic use, and in September 1991 it was announced that gas imports will not be authorized in 1992.[50/] Yemen currently produces gas at the Alif field, but this gas is used for re-injection purposes.

49/ Arab Oil and Gas, 16 September 1991, p. 16.

50/ Ibid., p. 17.

III. OIL AND GAS EXPLORATION IN THE ESCWA REGION

During the period 1990-1991, exploration for oil and gas continued, especially in ESCWA countries, with modest reserve levels and considered as having potential on a geological basis. Exploration activity was notable in Egypt, Oman, the Syrian Arab Republic and the Republic of Yemen. Interruptions in exploration activity occurred during this period as a result of border disagreements between Saudi Arabia and the Republic of Yemen.

Exploration efforts offshore in the Gulf of Suez proved successful in early 1991 when two discoveries of heavy crude oil flowing at 7,500 b/d and 10,000 b/d were reported.[51/] Furthermore, indications at Zaafarana are that an oil field of 100-200 million barrels exists. Also, a well drilled in the central Gulf yielded a discovery of oil flowing at 10,700 b/d while another well drilled in a previously untested part of the central Gulf area resulted in a discovery with a flow of 33,000 b/d. Officials are also optimistic that further gas reserves will be found in Egypt and estimate that reserves will reach 2,265 billion cubic metres by 2010.[52/] Discoveries were made in late 1991 and early 1992 offshore and in the Nile Delta and western desert areas.

Oman also announced two new discoveries of gas during 1991 located in the northern part of the country, close to areas where gas had previously been found.[53/] These and other discoveries made in 1990 are a result of serious exploration efforts on the part of Oman which are continuing. Various licenses for exploration and drilling during 1991 were awarded in the Haffar area believed to be rich in gas.[54/]

Exploration efforts continue in the Syrian Arab Republic and discoveries during 1990 included one at Mazra'a of 2,500-3,000 b/d and one in Ash-Shaer of almost 3,000 b/d.[55/] During 1991, further discoveries were made at Deir ez-Zor, where light crude flowing at 9,400 b/d was found, and in Galban, Abou Hardan and Mqaat, all of which are under assessment for commercial viability.

Exploration efforts undertaken by the United Arab Emirates have been successful and reserves for 1992 have been reassessed recently at 8,891 billion cubic metres. Exploration for both oil and gas is continuing in the United Arab Emirates, and endeavours are expected to intensify during the next five years. The number of rigs devoted to exploration will increase from 12 in 1991 to 20 in 1992.

51/ Petroleum Economist, August 1991, p. 17.

52/ Middle East Economic Digest, 3 April 1992, p. 16.

53/ Middle East Economic Survey, 24 June 1991, p. A7.

54/ Arab Oil and Gas, 1 October 1991, p. 23.

55/ Petroleum Economist, April 1992, p. 10.

The Republic of Yemen signed a number of exploration agreements with foreign companies after the unification of the former Yemen and Democratic Yemen in 1990. Exploration licenses have been granted in the Shabwa district which is thought to have high potential as well as in other areas of the country. The terms of these agreements are reported to be favourable to the Republic of Yemen. An oil discovery with a flow of 3,700 b/d was announced in early 1991. Exploration efforts in northern areas of the country face some uncertainty since territorial claims by Saudi Arabia in late 1991 cover areas currently under exploration by foreign companies operating in the Republic of Yemen. One foreign company, British Petroleum, ceased activities in the Red Sea as a result, though many other companies remain.56/

56/ Petroleum Economist, July 1992, p. 24.

IV. RECENT DEVELOPMENTS IN THE ELECTRICITY SECTORS OF WESTERN ASIA

During the period 1990-1991, the provision of electric power in Western Asia was temporarily affected by the Gulf War and civil strife in Lebanon while efforts continued at expanding services to rural areas of the region and creating interconnections among systems of the region.

The Gulf crisis interrupted services in Iraq and Kuwait though electric energy generation was resumed rather quickly once the war ended. Iraq's capability was completely disrupted as most of its power stations were targeted during the first days of the war. By May 1991, however, the electricity grid was reconnected, and electricity was made available in larger cities and towns. By early 1992, 75 per cent of the grid had been brought back on line. Kuwait also restored its electricity production capabilities soon after the end of the war. In 1990, Kuwait's installed capacity totalled 6,790 megawatts (MW), and by October 1991, 4,000 MW had been restored along with 95 per cent of the network. Work included repairing power plants as well as transmission cables and substations.

Civil strife in Lebanon interfered with normal power supplies throughout the eighties. Although the civil war has ended, electricity services have not yet been restored to pre-war levels. Power shortages occur throughout the country, and many Lebanese generate electricity with individually-owned diesel engines. However, priority is being given to the electricity sector in rebuilding plans. Lebanese officials estimate that the provision of adequate electricity supplies will cost $US 1.18 billion which includes the cost of building two new electricity generating plants with a total capacity of 900 MW. Regional funding organizations including the Arab Fund for Economic and Social Development (AFESD) and the Kuwait Fund for Arab Economic Development have pledged substantial support for this endeavour, and Lebanon also has prospects for funding from outside the region.

Efforts are continuing to provide electricity to rural areas of the ESCWA region. Jordan, for instance, recently announced that efforts are under way to provide electricity to 3,000 additional villages inhabited by more than 70,000 people. The JD 20 million required for this project will be raised internally by increasing fees by one fils (JD 0.001) per kilowatt. Oman is also undertaking efforts to improve its capability to provide electricity to rural areas.

Demand for electricity has increased in Yemen due to the influx of approximately 850,000 returnees from the Gulf area shortly after the outbreak of the Gulf crisis in 1990. Construction of a 180-MW electricity-generating plant near Sana'a is planned once financing is secured. Efforts are also under way to connect the two systems in the northern and southern parts of the country. Yemen is also considering the option of using recently discovered natural gas reserves for the production of electricity. This would entail the conversion of existing power plants to gas and, in the long run, the construction of additional power plants which utilize gas. Egypt has also experienced considerable increases in the demand for electricity in the past few years, and demand is expected to continue to increase at a rate of 6 per cent or more to the year 2005. The Syrian Arab Republic overcame some

of its previous problems in meeting electricity demand, and electricity generation increased by 6.7 per cent in 1991. Hydroelectric power accounted for 13.4 per cent of total electricity supplied. The Syrian Arab Republic is investigating the possibility of utilizing recently discovered natural gas in the generation of electricity.

The interconnection of electricity systems remains a goal of most countries in the region. Efforts are under way to connect Egypt and Jordan. This project should be operational by 1996. Longer-run plans include further connections to the Syrian Arab Republic, Lebanon, Turkey and eventually Iraq. Similar plans to connect the systems of the Gulf Cooperation Council countries exist, and the results of a detailed study were discussed in early 1992 by the six countries. Originally, the plan was expected to be completed by 2005, but its implementation was delayed due to the Gulf crisis. Once the two grids are completed, the possibility of connecting them will exist, which will enable electric power to be shared throughout Western Asia. A recently completed study commissioned by AFESD reported that a unified Arab power grid would save the Arab countries a total of $US 4 billion. The project, estimated at a cost of $US 3.1 billion, could be completed in 20 years.

Table 13. Energy generation and installed capacity in the ESCWA region, 1985-1990

Country	Year	Installed capacity (MW)	Generated electricity (GWh)
Bahrain	1985	988	2 937
	1986	988	3 211
	1987	1 078	3 316
	1988	1 040	3 482
	1989	1 040	3 490
	1990	1 040	3 490
Egypt	1985	9 067	34 030
	1986	10 027	35 300
	1987	11 598	36 290
	1988	11 682	38 295
	1989	11 738	39 300
	1990	11 738	39 550
Iraq	1985	3 400	20 994
	1986	3 700	22 297
	1987	6 100	24 350
	1988	8 000	27 410
	1989	9 000	28 900
	1990	9 000	29 160

Table 13. (continued)

Country	Year	Installed capacity (MW)	Generated electricity (GWh)
Jordan	1985	712	2 495
	1986	983	2 955
	1987	980	3 486
	1988	980	3 262
	1989	1 048	3 339
	1990	1 048	3 638
Kuwait	1985	5 230	15 689
	1986	5 530	17 216
	1987	6 060	18 400
	1988	6 580	19 998
	1989	6 690	20 510
	1990	6 790	20 610
Lebanon	1985	819	3 861
	1986	819	4 170
	1987	819	4 600
	1988	819	4 505
	1989	819	4 585
	1990	870	4 735
Oman	1985	1 107	2 899
	1986	1 157	3 617
	1987	1 446	3 885
	1988	1 477	4 408
	1989	1 495	4 707
	1990	1 531	5 345
Qatar	1985	1 005	3 949
	1986	1 095	4 303
	1987	1 095	3 420
	1988	1 195	4 500
	1989	1 205	4 512
	1990	1 410	4 624
Saudi Arabia	1985	13 923	32 791
	1986	14 761	36 171
	1987	15 279	40 607
	1988	15 601	42 201
	1989	17 150	46 300
	1990	18 510	47 400

Table 13. (continued)

Country	Year	Installed capacity (MW)	Generated electricity (GWh)
Syrian Arab Republic	1985	2 918	8 038
	1986	2 918	7 942
	1987	2 612	7 989
	1988	3 230	9 614
	1989	3 555	10 329
	1990	3 717	10 600
United Arab Emirates	1985	3 920	11 614
	1986	4 300	12 610
	1987	4 420	13 100
	1988	4 430	13 150
	1989	4 500	13 270
	1990	4 660	13 590
Republic of Yemen*	1985	420	910
	1986	638	1 164
	1987	680	1 228
	1988	800	1 665
	1989	800	1 680
	1990	800	1 740

Source: Compiled from the Energy Data Bank of the Economic and Social Commission for Western Asia and national sources.

Note: * For the years 1985-1989 the Republic of Yemen includes the former Yemen and Democratic Yemen. The two countries were united in 1990.

V. RECENT DEVELOPMENTS IN RENEWABLE SOURCES OF ENERGY IN THE ESCWA REGION

During the period 1990-1991, the use of new and renewable resources was actively encouraged in many ESCWA countries. Egypt, the Syrian Arab Republic and Yemen witnessed increases in the use of renewable energy sources as well as pilot projects sponsored by Governments and international organizations and training programmes designed to promote the use of renewable energy technologies. Renewable energy sources are becoming increasingly attractive as environmental hazards associated with the use of conventional hydrocarbon sources of energy have been identified and acknowledged.

A wind farm was successfully installed in Egypt and is now connected to the local power grid at Ras Ghareb, about 320 kilometres south-east of Cairo on the Red Sea.[57/] About 1.2 million kilowatt-hour (kWh) is generated annually by the wind farm which supplements energy generated by local power plants fueled with conventional energy sources. The coastal areas of the Red Sea are considered ideal areas for utilizing wind power in Egypt and studies are under way to determine their feasibility. Possibilities also exist for utilizing wind/diesel hybrid systems to generate electricity in remote areas.

Solar energy also holds promise in many countries of the region with high solar radiation intensities. A working photovoltaic-powered ice machine was recently installed in Wadi El Raiyan, about 60 kilometres west of El-Faiyum, Egypt.[58/] The ice is needed to transport locally harvested fish to consumers in major population centres including Cairo and Alexandria. Power is generated from a stand-alone PV/diesel hybrid power system and serves all the power needs of the ice-making plant. The photovoltaic system is designed to provide 40 per cent of the total electricity required.

Solar water heaters are currently used in Egypt and a total of approximately 30,000 heating units exist. They are supplied by local private and public companies which can produce 100,000 systems each year. The Egyptian Government is encouraging the use of solar water heaters and has required all new buildings to be equipped with systems. Solar energy is also used in the General Poultry Plant, which processes 100,000 chickens per day and is located in Heliopolis, near Cairo.[59/] The solar water heaters and waste heat recovery system began operating in 1991 in Helwan. The system uses flat plate collectors in a 356-square-metre solar array and is estimated to save 2,200 barrels of oil each year. Another industrial solar water heater is under construction at the textiles complex in Helwan, about 30 kilometres south of Cairo, and will be operating in 1992.

57/ United States Agency for International Development and Government of Egypt, Ministry of Electricity and Energy, An Overview of Egyptian Renewable Energy Programs and the Renewable Energy Field Testing Project (Nasr City, Egypt: New and Renewable Energy Authority), 1990.

58/ Ibid.

59/ Ibid.

Solar water heaters are also used widely in Jordan and are constructed and installed by the private sector. Changes in exchange rates in 1988 which resulted in a decrease in the value of the Jordanian currency caused an increase in the cost of imported system components, making them less competitive with conventional sources. However, recent and expected increases in conventional sources of energy will improve the economic feasibility of solar water heaters in Jordan.

Due in part to the efforts of international organizations such as the United Nations, biogas technology was more widely used in the ESCWA region during this period. A three-year pilot project, funded by the United Nations Development Programme (UNDP) and executed by the Economic and Social Commission for Western Asia (ESCWA), demonstrating the advantages of biogas in rural areas of the region was successfully concluded in December 1991.60/ The introduction of biogas technology in a rural village demonstrated the benefits of utilizing animal wastes to provide energy for cooking and lighting. Currently, biogas systems serve the 80 families in the village. Initial investigations show that in addition to the improvement in living standards resulting from the use of a renewable energy source and the biogas technology, local health standards improved due to the systematic collection of animal wastes in the village, and the burden of firewood collection, which was borne by the women of the village, was decreased considerably.

A regional training workshop funded by UNDP and organized by ESCWA was held from 1 August to 3 September 1991 in the Syrian Arab Republic to train 19 engineers from Jordan, Egypt, Oman, the Syrian Arab Republic and Yemen to build biogas digesters. The workshop ended with the building of integrated biogas systems including digesters, a solar water heating facility and a greenhouse to heat the mixture in the digesters during cold winter months. The gas produced is used in cooking, lighting and grilling meat.

60/ Saleh, Mahmoud, et. al., Diffusion of Biogas Technology in the Southern Part of Yemen: The Development of Women in Mansourat Al-Habeel Village, Annex III of Report on Mission to Republic of Yemen by M.A. Saleh and T. A. Obaid, United Nations Economic and Social Commission for Western Asia, 13 December 1991.

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FOR WESTERN ASIA

Energy and Natural Resources Division

SURVEY AND ASSESSMENT OF ENERGY-RELATED ACTIVITIES IN THE ESCWA REGION, 1990-1991

Corrigendum

Page 1, table 1, column headings

The headings should read

	Arabian light		Oman (blend)		OPEC basket	
Month	1990	1991	1990	1991	1990	1991

Page 4, table 3

In the column headed "Percentage change, 1991/1989", the item for "Total demand" should read 0.3

Page 7, table 6, head-note

For Thousands of barrels read Thousands of barrels/day