



UNITED NATIONS
ECONOMIC AND SOCIAL COUNCIL

Distr.
GENERAL
E/ESCWA/NR/89/12
20 September 1989
ORIGINAL: ENGLISH

ECONOMIC AND SOCIAL COMMISSION FOR WESTERN ASIA
Natural Resources, Science and Technology Division

UN ECONOMIC AND SOCIAL COMMISSION
FOR WESTERN ASIA
3 - DEC 1986
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**SURVEY AND ASSESSMENT OF ENERGY-RELATED ACTIVITIES AND
DEVELOPMENT IN THE ESCWA REGION, 1988**

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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, as 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 significant portion of the region's gross domestic product (GDP). The major oil producers - Iraq and the countries of the Gulf Co-operation Council (GCC) - accounted for 21 per cent of the world's total production in 1988. Other ESCWA countries also benefit indirectly from the sale of oil by the major ESCWA producers through labour remittances, interregional trade, grants and aid and lending programmes. Oil reserves also exist in other ESCWA countries and oil is sold on the international market by Egypt, the Syrian Arab Republic and, more recently, by Yemen. These countries were also directly affected by the developments in the international oil market during 1988.

1. Oil prices

Oil prices fell during most of 1988 as members of the Organization of Petroleum Exporting Countries (OPEC), including those in the ESCWA region, substantially increased their production levels, in many cases beyond the levels allowed by their quotas. In addition, the cessation of hostilities between Iraq and Iran resulted in greater amounts of oil from both of these countries being sold internationally. Table 1 shows the monthly averages of various oil prices during 1988. Oil producers adopted a new method of pricing called "formula pricing" which allows variations in prices according to geographical location. The price was typically tied to the spot price of a crude oil produced in the market region. For instance, for many Middle Eastern crudes, the price of oil sold in North America was based on the price of Alaskan crude, while the price of crude oil sold to Europe was tied to the price of Brent oil. The price of Oman 340^o crude was used as the basis for prices charged to the Far East. Formula pricing allowed ESCWA region producers to compete with crude oil produced closer to local markets, though in effect producers have born at least part of the costs of transporting the oil to the consumers.

Table 1 reveals that oil prices fell steadily during most of 1988. A slight rise in prices occurred at the very end of the year as prospects for an OPEC agreement on production levels improved. The fall in prices resulted in a decline in oil revenues for many ESCWA producers, despite the significant increase in output levels during 1988. Oil-producing and consuming nations alike were concerned with the rapid and significant fall in oil prices and non-OPEC countries made an effort to cut their production levels in an attempt to encourage OPEC producers to halt their production increases.

Table 1. Formula prices, 1988

(Saudi Arabia 340° light)

| | Rotterdam ^{a/} | US Gulf Coast ^{a/} | Far East ^{b/} | Netback price |
|--------------|-------------------------|-----------------------------|------------------------|---------------|
| January | 16.39 | 15.90 | 17.52 | 14.43 |
| February | 15.19 | 15.09 | 17.52 | 13.97 |
| March | 14.15 | 14.34 | 17.52 | 13.07 |
| April | 15.97 | 16.23 | 15.35 | 15.12 |
| May | 15.85 | 15.36 | 15.33 | 14.91 |
| June | 15.03 | 14.74 | 14.18 | 14.32 |
| July | 14.37 | 14.29 | 13.40 | 13.51 |
| August | 14.34 | 14.02 | 13.53 | 13.58 |
| September | 12.58 | 12.67 | 11.78 | 12.20 |
| October | 11.70 | 11.54 | 10.40 | 11.57 |
| November | 12.24 | 11.44 | 10.73 | 13.29 |
| December | 14.40 | 14.10 | 12.60 | 14.66 |
| Average 1988 | 14.35 | 14.14 | 14.16 | 13.64 |

Source: Formula prices from Petroleum Intelligence Weekly, vol. XXVIII, No. 4 (23 January 1989).

^{a/} Delivered netback price for Oil and Energy Trends, vol. 14, No. 1 (20 January 1989), p. 14.

^{b/} At source.

2. World supply of oil

The major cause of falling oil prices during 1988 was the significant increase in production. Table 2 compares world oil production in 1988 with the previous year and reveals that total world production increased by 4 per cent.

Table 2. World estimated oil production, 1987 and 1988

(Thousands of barrels/day)

| | 1987 | 1988 | Percentage change |
|--------------------------------|--------|--------|-------------------|
| ESCWA | 11 034 | 12 882 | 16.8 |
| OPEC | 18 642 | 20 705 | 11.1 |
| Market economies ^{a/} | 42 841 | 45 125 | 5.3 |
| World | 58 433 | 60 753 | 4.0 |

Source: Petroleum Economist, vol. LVI, No. 1 (January 1989), p. 4. Data converted from tonnes.

^{a/} Including OPEC countries.

Production in the world's market economies increased by 5.3 per cent during 1988. In an apparent effort to increase their individual market shares, OPEC members increased production by 11.1 per cent. Total ESCWA production was 16.8 per cent higher than in 1987, mainly owing to the significant production increases of the major ESCWA producers which are also members of OPEC.

Lack of agreement on quota levels within OPEC was the original cause of increases in OPEC production. Other OPEC members responded to "cheating" with their own increases, causing serious drops in prices especially in the later part of the year. OPEC members met in November 1988 and resolved a number of problems including agreeing on quotas for Iraq and Iran, establishing a precise definition for "condensates"^{1/} (including "divided zone" production in the quotas for Saudi Arabia and Kuwait), and agreeing on new quotas for 1989. Production levels were generally maintained within these quotas during the early part of 1989.

Major developments outside the sphere of OPEC included two North Sea accidents which adversely affected the output of the United Kingdom, the international sale of oil from centrally planned economies and the decline in the production level of the United States. Major accidents in the North Sea caused the United Kingdom's oil output to drop 6.7 per cent below that of 1987.^{2/} However, this reduction can be viewed as being only temporary, since the United Kingdom has increased its development activities. By the end of 1988, a number of North Sea development projects were under way which will increase production by 50 per cent over 1987 levels.^{3/} Most of these projects are scheduled to enter into production in 1989 and 1990 and will add 400,000 barrels per day (b/d) to the total oil production of the United Kingdom.^{4/} The declining trend in output is expected to be reversed by the mid-1990s owing to the increase in development spending, as well as recent advances in technological efficiency.^{5/} Norway is carrying out development activities, but at roughly the same level as in 1987. The Union of Soviet Socialist Republics (USSR) increased its sale of oil and oil products on the international market, but production declined somewhat during the third quarter of 1988.^{6/} Although exports of oil and oil products account for 60 per cent of hard currency earnings of the Soviet Union, its ability to sustain

^{1/} Some OPEC countries had been selling light crude as condensates which were not included in their quota.

^{2/} Petroleum Economist, vol. LVI, No. 1 (January 1989), p. 4.

^{3/} Petroleum Intelligence Weekly, vol. XXVII, No. 43 (24 October 1988), p. 7.

^{4/} Ibid.

^{5/} Ibid., vol. XXVIII, No. 7 (13 February 1989), p. 4.

^{6/} Arab Oil and Gas, vol. XVIII, No. 415, (1 January 1989), p. 24, and Isabel Gorst, "Soviet Union: oil exports rise to record level", Petroleum Economist, vol. LVI, No. 2 (February 1988), p. 43, and Isabel Gorst, "Soviet Union: oil exports by volume and country", Petroleum Economist, vol. LVI, No. 1 (January 1989).

high export levels has been questioned owing to possible domestic shortages and a projected levelling off of oil production levels in the 1990s as production capacity is reached.^{1/} The United States, another major non-OPEC producer, experienced a decline in oil production of 1.4 per cent in 1988. This is thought to be the beginning of a longer term, substantial decline as low oil prices have encouraged the closing of smaller, relatively costly wells and discouraged exploration and development activities. Oil prices in the 20 dollar (\$)/barrel range are required to induce a reversal of the downward trend in United States oil output.^{2/}

The prospects for non-OPEC oil production depend on many factors, including prices. Certainly, lower prices have recently tended to discourage exploration and development activities. Other factors that will influence future non-OPEC production levels include the size of the resources base, exploration and development costs, the rate of technological advances, and government policies.^{3/} Non-OPEC countries currently hold 530 billion barrels or one third of world reserves but, on the basis of current technology, the development of a large proportion of these reserves will only occur if prices range between \$15 and 25/barrel.^{4/} Uncertainties and high fluctuations in prices have affected exploration and development decisions in some non-OPEC countries. Non-OPEC oil production is expected to remain significantly high until the mid-1990s, but by the late 1990s a decline in production is expected.^{5/} Non-OPEC countries are concerned about the low and varying prices experienced during the 1980s; attempts were made by some OPEC and non-OPEC members to co-ordinate production policies during 1988. Norway and Mexico both announced specific policies to control output in support of OPEC. Other countries, while not making formal announcements, appear to have reduced production in line with OPEC cuts in late 1988 and early 1989.

^{1/} The Soviet Union currently is encouraging foreign exploration and joint ventures within its borders; as a result, its production capacity may increase in the long-term. See Oil and Gas Journal, 27 February 1989, pp. 34-38.

^{2/} Petroleum Intelligence Weekly, vol. XXVII, No. 44 (31 October 1988), p. 4.

^{3/} Andrew B. Gordon, "Non-OPEC oil production", Petroleum Economist, vol. LV, No. 7 (July 1988), p. 235.

^{4/} Ibid., p. 236.

^{5/} Ibid. However, long-term increases in non-OPEC output have been forecast. See, Petroleum Intelligence Weekly, vol. XXVIII, No. 19 (8 May 1989), pp. 6-7.

3. World demand for oil

Since most of the countries of the ESCWA region sell oil on international world markets, changes in the demand for oil directly affect the region. Decreases in demand result in a loss of hard currency earnings for the oil-exporting countries of the region, and this adversely affects their GDP. The countries of the region which have no oil reserves and those which have only limited reserves also lose the indirect benefits accruing from labour remittances from nationals working in the major oil-exporting countries and from reductions in grants and aid from these same countries.

After decreasing for several years, the demand for oil increased during 1988, partly owing to a strong surge in demand during the fourth quarter of the year. Table 3 shows world oil demand in 1987 and 1988 projected demand for 1989.

Table 3. World oil demand, 1987-1989

(Millions of b/d)

| | 1987 | 1988 | 1989 ^{a/} |
|--------|------|------|--------------------|
| OECD | 35.9 | 36.7 | 37.3 |
| OPEC | 3.5 | 3.5 | 3.5 |
| Others | 9.2 | 9.9 | 10.3 |
| Total | 48.6 | 50.1 | 51.1 |

Source: Gulf International Bank, Gulf Economic and Financial Report, November 1988, p. 4 and, International Crude Oil and Product Prices, January 1989 (Cyprus, 1989), p. 10.

^{a/} International Energy Agency Projection.

The demand for oil grew by 3 per cent, which was much higher than expected. This higher than expected increase was mainly the result of higher consumption levels in the United States and Japan. The United States importation of oil rose by 9 per cent, while oil consumption in Japan grew by 4.9 per cent during 1988.^{1/} A large percentage of United States imports came from three ESCWA countries: Saudi Arabia, Kuwait and Iraq. In fact, total imports by the United States from Saudi Arabia, Kuwait and Iraq rose by almost 70 per cent.^{2/} The significant increase in ESCWA region sales to the United States can be attributed in part to formula pricing which reduced the

^{1/} Petroleum Intelligence Weekly, vol. XXVIII, No. 10 (6 March 1989), p. 4, and Arab Oil and Gas, vol. XVIII, No. 415 (1 January 1989), p. 7.

^{2/} Petroleum Intelligence Weekly, vol. XXVIII, No. 10 (6 March 1989), p. 4.

cost disadvantage of transportation. Future United States demand depends to some extent on government policy with regard to energy issues such as gasoline taxes, import duties and the strategic petroleum reserve level.^{1/} Demand for oil in the United States is expected to grow by 1.6 per cent in 1989.^{2/} Imports of oil should increase by 500,000 barrels per day as a result of the increase in demand and expected decreases in production during 1989.^{3/}

The increase in 1988 oil demand is not generally attributed to the decline in prices, since there is usually a longer time lag before the price of oil affects demand. Also, product prices in the United States remained relatively stable during 1988, though the increase in petroleum products was the main contributor to the increase in demand for oil.

The decrease in oil prices, even if they remain at a low level, is not expected to result in higher consumption since the increase in the value of the United States dollar, the medium of payment in most cases, has improved in terms of other major currencies. For example, from June to August 1988 the dollar price of oil^{4/} fell by 6.5 per cent but, when calculated in Japanese yen the price of oil fell by 1.2 per cent and by only 0.4 per cent in deutsche marks.^{5/}

4. Oil stock level

During 1988 there was some confusion over the exact amount of stocks held. Production increased dramatically and at first it was not clear if the additional supplies were being consumed or stockpiled. By the end of the year, however, it appeared that inventory levels had not kept pace with the rise in production levels. Stocks held on land by industrialized countries on 1 January 1989 were 35 million barrels lower than in the previous year.^{6/} The combined stocks held on land in the United States, Japan and Europe, which

1/ Though many in the United States have recommended such measures (see, for example, Daniel Yergin, "Energy security in the 1990s", Foreign Affairs, Fall 1988, pp. 110-132), the present Administration is not actively promoting policies to reduce domestic energy consumption. See Petroleum Economist, vol. LVI, No. 2 (February 1989), p. 62, and Petroleum Intelligence Weekly, vol. XXVII, No. 46 (14 November 1988), p. 5.

2/ Petroleum Intelligence Weekly, vol. XXVIII, No. 8 (20 February 1989), p. 4.

3/ Ibid.

4/ Dubai crude oil price.

5/ Petroleum Intelligence Weekly, vol. XXVII, No. 36 (5 September 1988), p. 5.

6/ Petroleum Intelligence Weekly, vol. XXVIII, No. 11 (13 March 1989), p. 6.

account for 60 per cent of world stock levels, were 2,038 million barrels in early January 1989, down from 2,120 million barrels in early January 1988.^{1/} By November 1988, Europe held 905 million barrels of crude oil and oil products, which represented a significant decrease over the previous year's level of 917 million barrels.^{2/} The United States stock level decreased in December 1988 to 336 million barrels in the middle of the month, while by November 1988 Japan's stock levels were down by 14 per cent from the previous year's level.^{3/} The stock draw-down at the end of the year was due, in part, to the unexpected increases in demand.

Part of the confusion over stock levels arises from lack of accurate data, especially when trying to estimate current levels. It is thought that some stocks were held at sea by major oil producing countries during the fourth quarter of 1988. Estimates put total floating storage in mid-December at 125 to 150 million barrels.^{4/} Saudi Arabia was thought to have between 70 and 80 million barrels in floating storage at that time.^{5/} Reports of floating storage by major oil-exporting countries were viewed as a potential loophole for OPEC members through which their sales could exceed their quota levels. OPEC members, in fact, agreed to include inventory sales in their quota levels for the first half of 1989.

Though changes in stock levels occur frequently and often result as a response to market conditions, the long-term trend seems to be one of decreasing stock levels. The stocks held by oil companies on 1 January 1989 were the lowest since 1979.^{6/}

5. Market restructuring of the international oil market

The international oil market has undergone a process of restructuring in recent years, and a trend toward a higher degree of vertical concentration has

^{1/} Arab Oil and Gas, vol. XVIII, No. 419 (1 March 1989), p. 26.

^{2/} Petroleum Intelligence Weekly, vol. XXVII, No. 51-52 (19 December 1989), p. 7.

^{3/} Arab Oil and Gas, loc.cit.

^{4/} Ibid., p. 7.

^{5/} Ibid.

^{6/} Petroleum Intelligence Weekly, vol. XXVIII, No. 11 (13 March 1989), p. 6.

emerged in the industry.^{1/} This trend continued during 1988 with major sales of oil and gas reserves, as well as downstream operations. In the United States, more refineries were sold in 1988 than in any year since 1982.^{2/} Their prices have been increasing; in 1988 the prices were two to four times those of previous years.^{3/} Oil-exporting countries, including Kuwait, now own 3.5 per cent of the refinery capacity of the European Economic Community.^{4/} Some ESCWA countries participate in this activity through purchases of downstream marketing facilities in major oil-consuming countries.

Kuwait, the most active ESCWA member in this regard, suffered a setback in 1988 when it was asked by the United Kingdom to reduce its holdings of British Petroleum (BP) from 21.6 per cent to 9.9 per cent.^{5/} British Petroleum actually purchased the stock from the Kuwait Investment Organization (KIO) in early 1989 in an arrangement that allowed KIO to realize an annual rate of return of 30 per cent on the shares sold.^{6/} The British Petroleum stock had been purchased by Kuwait as part of its investment portfolio, and Kuwait had emphasized that it did not plan to interfere in the company's operations. Kuwait also owns more than 4,500 total outlets world-wide under the auspices of Kuwait Petroleum International.^{7/} This allows Kuwait to sell oil products directly to consumers in major oil-consuming countries. Kuwait intends to purchase more retail facilities,^{8/} and is exploring possibilities in the Far East, France, the Federal Republic of Germany and the United States.^{9/}

1/ At least one study blames this phenomenon on the lack of United States product price response to the general fall in oil prices during 1988. See Oil and Gas Journal (9 January 1989). For a comparison between this phenomena and the oil market during the 1960s see, too, M. S. Robinson "Anatomy of downstream integration by oil-producing countries", Natural Resources Forum, February 1989, pp. 71-74, and Michael Kelly "Restructuring of the world oil market", Middle East Economic Survey, vol. XXXII, No. 25 (27 March 1989), and Fariboz Ghadar "The impact on new OPEC downstream operations on oil industry structure" in Petroleum Resources and Development, Kamel I. F. Khan, ed. (London, Belhaven Press, 1987), pp. 232-245.

2/ Petroleum Intelligence Weekly, vol., XXVIII, No.11 (13 March 1988), supplement p. 4.

3/ Ibid.

4/ Arab Oil and Gas, vol. XVIII, No. 415 (1 January 1989), p. 35.

5/ Oil and Gas Journal, 10 October 1988, p. 34.

6/ Oil and Gas Journal, 9 January 1989, p. 20.

7/ Petroleum Economist, vol. LV, No. 4 (April 1988), p. 130.

8/ Ibid.

9/ Ibid.

Saudi Arabia made a major investment in 1988 in downstream facilities with its purchase of a half interest in refineries and retail outlets in the United States.^{1/} The purchase from Texaco was for \$812 million and over 22 million barrels of crude oil. It was one of the largest refinery transactions in the world during 1988. Saudi Arabia is currently investigating similar downstream facility investment opportunities in Europe.^{2/}

The United Arab Emirates has also taken steps in this direction and has a 10 per cent interest in the Spanish refining group Cepsa; it recently increased its interest in Total-CFP (France) from 8 per cent to 12 per cent.^{3/} Officials recently indicated that the United Arab Emirates is interested in expanding its investments in downstream facilities in major oil-consuming countries.^{4/}

B. Oil-related developments in the ESCWA region

1. ESCWA region oil reserves in 1988

The total oil reserves of the ESCWA region amount to 565,337 million barrels,^{5/} which constitutes a substantial portion of the world's total reserves (as shown in table 4). ESCWA region reserves are illustrated by country in table 4. Most ESCWA countries experienced very little change in total reserves during 1988. Saudi Arabia, however, announced an increase in its reserves in early January 1989 of slightly over 50 per cent.^{6/} Saudi Arabia's oil reserves, including its share of the divided zone reserves, increased from 169,585 million barrels in 1987 to 254,985 million barrels in January 1989. This increase was the result of a six year project of data re-evaluation. Further increases in reserves are expected as exploration activities increase. Reserves could reach 315,000 million barrels.^{7/} Total ESCWA reserves increased by 18.7 per cent during 1988, mainly owing to the increase in Saudi Arabia's reserves. Saudi Arabia now holds approximately 25 per cent of total world reserves.

^{1/} Petroleum Intelligence Weekly, vol. XXVII, No. 46 (14 November 1988), p. 3 and ibid., vol. XXVIII, No. 11 (13 March 1989), special supplement, p. 4.

^{2/} Ibid., (20 February 1989), p. 1.

^{3/} Oil and Gas Journal, 13 March 1989, p. 35 and Middle East Economic Survey, vol. 32, No. 25 (27 March 1989), p. A14.

^{4/} Oil and Gas Journal, 13 March 1989, p. 35.

^{5/} Including newly revised figures for Saudi Arabia.

^{6/} Arab Oil and Gas, vol. XVIII, No. 416 (16 January 1989), p. 9.

^{7/} Ibid.

Table 4. ESCWA region proven oil reserves, 1987 and 1988

(Millions of barrels/end of the year)

| | 1987 | 1988 | Percentage change 1987-1988 |
|--|---------|---------|--------------------------------|
| Bahrain | 141 | 126 | 10.7 |
| Democratic Yemen | | 3 380 | |
| Egypt | 4 300 | 4 300 | 0.0 |
| Iraq | 100 000 | 100 000 | 0.0 |
| Jordan | 12 | 5 | -58.3 |
| Kuwait | 94 525 | 94 525 | 0.0 |
| Oman | 4 012 | 4 071 | 1.5 |
| Qatar | 3 150 | 3 150 | 0.0 |
| Saudi Arabia | 169 585 | 254 985 | 50.4 |
| Syrian Arab Republic | 1 750 | 1 730 | -1.1 |
| United Arab Emirates | 98 105 | 98 105 | 0.0 |
| Yemen | 550 | 1 000 | 81.8 |
| Total ESCWA | 476 130 | 565 377 | 18.7 |
| Total world | 887 348 | 992 420 | 11.8 |
| ESCWA share of world reserves (percentage) | 54 | 57 | |

Source: Oil and Gas Journal, various issues.

Notes: Includes 9 January 1989 revision of reserves by Saudi Arabia. Including divided zone reserves for Saudi Arabia and Kuwait.

2. ESCWA region oil production during 1988

ESCWA region oil production increased by 16.8 per cent during 1988 from 11,034,000 barrels per day (b/d) to 12,882,000 b/d, as can be seen from table 5. This overall increase was largely owing to increases in output by the region's major oil-producing countries. Iraq, Kuwait and Saudi Arabia experienced increases in output levels of 25.7, 18.8 and 19.8 per cent respectively. Iraq's output increased from 2,044,000 b/d to 2,571,000 b/d, partly owing to an increase in its export capacity and as a result of the cessation of hostilities in the region.

The increases in Kuwait and Saudi Arabia occurred as other OPEC members began producing amounts over their quotas. Saudi Arabia abandoned its former role as "swing producer" and increased production in line with other OPEC producers. Kuwait's output also increased accordingly. While the United Arab Emirate's output increased by a relatively smaller amount, its production of 1,458,000 b/d in 1987 was already significantly over its quota of 902,000 b/d.^{1/}

^{1/} See table 6 and Roger Vielvoye, "The UAE's quota", Oil and Gas Journal, 18 July 1988, p. 30.

Table 5. ESCWA region oil production, 1987 and 1988

(Thousands of b/d)

| | 1987 | 1988 | Percentage change |
|--------------------------|--------|--------|-------------------|
| Bahrain | 42 | 43 | 2.0 |
| Democratic Yemen | 5 | 12 | 140.0 |
| Egypt | 922 | 894 | -3.1 |
| Iraq | 2 044 | 2 571 | 25.7 |
| Kuwait | 1 234 | 1 466 | 18.8 |
| Oman | 568 | 592 | 4.4 |
| Qatar | 302 | 305 | 1.0 |
| Saudi Arabia | 4 209 | 5 041 | 19.8 |
| Syrian Arab Republic | 241 | 271 | 12.5 |
| United Arab Emirates | 1 458 | 1 532 | 5.1 |
| Yemen | 9 | 155 | 1 611.1 |
| Total ESCWA | 11 034 | 12 882 | 16.8 |
| Total OPEC | 18 642 | 20 705 | 11.1 |
| Total world | 58 433 | 60 753 | 4.0 |
| ESCWA percentage of OPEC | 59 | 62 | |
| ESCWA share of world | 19 | 21 | |

Source: Petroleum Economist, vol. LVI, No. 1 (January 1989), p. 4. Data converted from tonnes.

The OPEC quotas that affect ESCWA countries and their actual production levels are illustrated in table 6. Kuwait's production level was somewhat over its quota in 1987, and the difference increased considerably during 1988. Saudi Arabia maintained a level of production to close to its quota during 1987, but increased production to levels considerably greater than its quota in 1988. Iraq was not assigned a quota during 1988, though its production level was significantly higher than that for 1987.^{1/}

In late 1988 OPEC members met to resolve the overproduction problem, and new quotas were established for the first half of 1989. It is interesting to note that OPEC members agreed to increase total output from 16,600,000 b/d to 18,500,000 b/d.

ESCWA members' share of OPEC output, according to the new quotas, increased from 49 per cent to 51 per cent. Iraq's quota is significantly higher than its 1987 quota and is equal to Iran's quota. Iraq reduced its output, which reached 2,700,000 b/d during the last quarter of 1988, to within its quota range in early January 1989.^{2/} United Arab Emirates production also declined during the first half of January to 1,350,000 b/d, which is closer to its quota level. United Arab Emirates total production averaged over

^{1/} Iraq was not in agreement with the 1987 quota.

^{2/} Oil and Gas Journal, vol. XVIII, No. 416 (16 January 1989), p. 22.

Table 6. Quotas and production levels of ESCWA OPEC members, 1987-1989

(Thousands of b/d)

| | Quota (January- June) 1987 | Produc- tion 1987 | Quota 1988 | Produc- tion 1988 | Quota 1989 | Produc- tion early 1989 |
|-----------------------------------|----------------------------------|-------------------------|---------------|-------------------------|---------------|-------------------------------|
| Iraq | 1 466 | 2 044 | <u>b/</u> | 2 571 | 2 640 | 2 650 |
| Kuwait | 948 | 1 234 | 996 | 1 466 | 1 037 | 900 |
| Qatar | 285 | 302 | 299 | 305 | 312 | 320 |
| Saudi Arabia | 4 133 | 4 209 | 4 343 | 5 041 | 4 524 | 4 400 |
| United Arab Emirates | 902 | 1 458 | 948 | 1 532 | 988 | 1 350 |
| Total ESCWA ^{a/} | 7 734 | 9 247 | | 10 915 | 9 501 | 9 620 |
| Total OPEC | 15 800 | 18 642 | | 20 705 | 18 500 | 19 050 |
| ESCWA percentage share of OPEC | 49 | 48 | | 53 | 51 | 50 |

Sources: Petroleum Economist, various issues and Oil and Gas Journal, vol. XVIII, No. 416 (1 January 1989), p. 22.

a/ Members of OPEC.

b/ No quota assigned.

2,000,000 b/d during the last quarter of 1988.^{1/} The recent output level therefore constitutes a significant reduction over 1988 levels. Kuwait and Saudi Arabia also had higher output levels during the last quarter of 1988, which averaged slightly under 1,600,000 b/d and 6,600,000 b/d respectively; at the beginning of January 1989 their output levels were within their quota levels. Kuwait produced 900,000 b/d, an amount well within its quota of 1,037,000 b/d while Saudi Arabia produced 4,400,000 b/d, slightly under its new quota of 4,524,000 b/d. Qatar, another OPEC member, produced close to its quota of 312,000 b/d during 1988 (including the last quarter of 1988).

Oman's oil output increased by 4.4 per cent above its 1987 level to reach 592,000 b/d in 1988. Although Oman is not an OPEC member, it called for production restraint during 1988 when many OPEC members were producing at levels significantly higher than their quotas allowed.

Other oil-producing countries in the ESCWA region also experienced changes in their output levels. Bahrain's oil production rose slightly during 1988, despite declining reserves. Egypt was the only ESCWA country to experience a decline in oil production. Its output level fell by 3.1 per cent to 894,000 b/d. Egypt is expected to suffer further output declines owing to a drop in exploration and development expenditures some years ago. The Syrian Arab Republic's oil production increased during 1988 by 12.5 per cent from 241,000 b/d to 271,000 b/d. The Tayani field began producing 10,000 b/d in December 1988.^{2/} The recently discovered Omar field is expected to produce

^{1/} Arab Oil and Gas, vol. XVIII, No. 416 (16 January 1989), p. 22.

^{2/} Ibid., No. 419 (1 February 1989).

100,000 b/d at full capacity in late 1989.^{1/} This, together with additional output from smaller fields, will enable the Syrian Arab Republic to produce 400,000 b/d by the end of 1989. Jordan produces a small amount of oil, though not on a commercial basis. Details of its exact production during 1988 are not available. Jordan has reserves of oil shale amounting to over 30 billion tons. Although not produced commercially, a feasibility study was commissioned during 1988 to examine the potential of oil shale reserves in the south of Jordan.^{2/}

Democratic Yemen and Yemen increased their output significantly during 1988. Democratic Yemen's output increased from 5,000 b/d in 1987 to 12,000 b/d in 1988. Yemen's output increased from 9,000 b/d in 1987 to 155,000 b/d in 1988. Both countries began producing oil in 1987. Although low by regional standards, these output levels provide substantial hard currency earnings for the ESCWA region's least developed countries.

3. ESCWA region production and export capacity

Production capacity in the ESCWA region's major oil-producing countries has fallen since the early 1980s. This is the result of the mothballing of facilities and declining investments. Saudi Arabia, the region's largest producer of oil, can sustain the production of 6.8 million b/d in the long run. Its capacity reached 11 million b/d in 1979.^{3/} Saudi Arabia has mothballed 24 of its 48 gas-oil separation plants and has shut down a number of wells that can be quickly restarted. Saudi Arabia can increase its production capacity to 7 million b/d in a short amount of time but increases to its previous capacity level would take two to three years.^{4/} Kuwait's

Table 7. Production capacity for selected ESCWA countries, 1979-1990

(Millions of b/d)

| | 1979 | 1988 | 1990 ^{a/} |
|----------------------------|------|------|--------------------|
| Iraq | 4.0 | 2.7 | 4.0 |
| Kuwait ^{b/} | 3.6 | 2.0 | 2.2 |
| Qatar | 0.6 | 0.5 | 0.5 |
| Saudi Arabia ^{b/} | 11.1 | 6.8 | 8.3 |
| United Arab Emirates | 2.0 | 2.0 | 2.0 |

Source: Arab Oil and Gas, vol. XVIII, No. 417, (1 February 1989), p. 28.

a/ Forecasted.

b/ Including the divided zone.

1/ Petroleum Economist, vol. LVI, No. 5 (May 1989), p. 160.

2/ Middle East Economic Digest, vol. 32, No. 17 (29 April 1988), p. 22.

3/ Arab Oil and Gas, vol. XVIII, No. 417 (1 February 1989), p. 28, based on a report by the East-West Center, Honolulu.

4/ Oil and Gas Journal, 9 January 1989, p. 29.

productive capacity fell to 2.0 million b/d in 1988 from 3.6 million b/d in 1979. Qatar's productive capacity fell only slightly during the same period from 0.6 million b/d to 0.5 million b/d, while the United Arab Emirates experienced no change at all in its capacity of 2.0 million b/d.

The sharp decline in Iraq's production capacity from 4.0 million b/d in 1979 to 2.7 million b/d in 1988 was partly as a result of the hostilities which prevailed in the region throughout most of this time. Iraq, however, made considerable efforts during 1988 to improve its export capacity. During the course of the Iraq-Iran hostilities, it relied heavily on land transport and pipelines and was able to increase oil exports substantially after a sharp decline early in the decade. Iraq is currently focusing on repairing its damaged terminals, cleaning up the debris in its ports and expanding its pipeline system in its efforts to further increase its export capacity.^{1/} Iraq is expected to double its export capacity to 6 million b/d by the end of 1989 which will be higher than its production capacity. Its production capacity is expected to reach the 6 million b/d level in the coming decade.^{2/}

Other ESCWA oil-producing countries have also been successful in increasing their production and/or export capacity during 1988 mainly through successful production and development programmes.

Democratic Yemen, the Syrian Arab Republic and Yemen have experienced such increases and production levels are close to their capacity levels. The recent development of the Omar and Tayani fields in the Syrian Arab Republic have increased the overall productive capacity of this country. Yemen's oil production recently reached the 200,000 b/d level, which is the capacity of its pipeline system.^{3/} The development of its Alif and Azin fields do not yet justify expanding the pipeline, though the capacity could be doubled if needed.

4. ESCWA region oil revenues

Despite major increases in output levels of the ESCWA region, the oil revenues accrued by the region and by each ESCWA country fell significantly during 1988. Although estimates vary, it appears that oil revenues were almost as low as those accrued in 1986. The decrease in oil revenues in the six GCC countries ranged from the 7.5 per cent decrease experienced by Saudi Arabia to the 24.3 per cent decrease experienced by Kuwait.^{4/} Since oil revenues account for a significant portion of each country's GDP and government budget, this decrease will have adverse economic effects.

^{1/} Petroleum Intelligence Weekly, vol. XXVII, No. 47 (21 November 1988), p. 1.

^{2/} Ibid., p. 2.

^{3/} Petroleum Intelligence Weekly, vol. XXVIII, No. 6 (6 February 1989), p. 8.

^{4/} See estimates of oil revenues in Arab Oil and Gas, vol. XVIII, No. 417, (1 February 1989), p. 30.

Other ESCWA countries also experienced declining oil revenues during 1988. Countries such as Egypt and the Syrian Arab Republic, which lack the production flexibility of some of the major oil-exporting countries of the region, were unable to expand their output in order to counteract the effects of falling prices. The Syrian Arab Republic did increase its output by 12.5 per cent owing to previously planned oil development projects, but this was not enough to offset the effects of falling prices. Egypt's output actually fell during 1988 and resulted in even lower revenues.

Democratic Yemen, Iraq and Yemen increased their output levels during 1988 as a result of previously planned development projects, rather than as a strategy to keep last year's revenues from falling. Export facilities began operating in Iraq and Yemen during 1988 and, as a result, the revenues of these two countries did not suffer as much as they might have.

C. The ESCWA region refining industry

The ESCWA region benefited from the increased world-wide demand for refined products during 1988. Relatively new or recently updated refineries built for export purposes in the ESCWA region generally performed better than refineries in other parts of the world.^{1/} Many of the ESCWA region's major oil-exporting countries have made considerable investments in export-oriented refineries during recent years and are benefiting not only from the increase in product demand; they also have a technological advantage over other older refineries. Some producers in the GCC area are earning as much as \$3/barrel more on their refined product output than on the sale of their crude oil.^{2/} The world-wide demand for refined products is expected to grow unevenly in coming years. For instance, Japanese demand for refined products in the year 2000 is expected to be 26.2 per cent higher than 1987 levels, while European demand will increase by only 0.5 per cent per year to the year 2000.^{3/} Product demand in the United States, however, is forecasted to grow by 1.5 per cent per year until the end of this century.^{4/} The ESCWA region also produces refined products for local consumption, and local demand is expected to grow during the coming decade. At least one forecast predicts a possible shortage of petroleum products for local consumption by the end of the century if no further investments are made.^{5/}

Table 8 shows the number and capacity of refineries in the ESCWA region and the change from 1987. New refineries began operating in Egypt, Iraq and Saudi Arabia and total production capacity increased from 3,888,000 b/d in 1987 to 4,114,000 b/d in 1988 (or by 5.8 per cent).

^{1/} Petroleum Intelligence Weekly, vol. XXVII No. 43 (24 October 1988) p. 1.

^{2/} Ibid.

^{3/} Arab Oil and Gas, vol. XVIII, No. 415, (1 January 1989), p. 29, and Petroleum Intelligence Weekly, vol., XXVII, No. 44 (31 October 1988), p. 4.

^{4/} Petroleum Intelligence Weekly, vol. XXVII, No. 44 (31 October 1988) p. 4.

^{5/} See Organization of Arab Petroleum Exporting Countries, Monthly Bulletin, vol. 15, No. 3 (March 1989), p. 1.

Egypt opened its first refinery in August in Upper Egypt during 1988.^{1/} This new refinery has a capacity of 50,000 b/d and is expected to produce for the domestic market. Its capacity can be increased to 100,000 b/d if local demand warrants such an increase. Egypt's demand for petroleum products has increased throughout the 1980s and the Asyut facility was constructed as part of Egypt's overall refinery expansion plan.

Iraq is currently undertaking the repair of its Basra refinery as part of its reconstruction efforts. The 140,000 b/d facility was affected by the Iraq-Iran conflict but it is expected to be fully operational by the latter half of 1989.^{2/} Exports of refined products produced by the facility are expected to pass through the Arabian Gulf on a limited basis by spring 1989.^{3/}

Table 8. Number of refineries and refinery capacity in the ESCWA region, 1987 and 1988

| Country | 1987 | | 1988 | | Percentage change in capacity |
|----------------------|------|----------------|------|----------------|-------------------------------|
| | No. | Capacity (b/d) | No. | Capacity (b/d) | |
| Bahrain | 1 | 250 000 | 1 | 243 000 | -2.8 |
| Democratic Yemen | 1 | 170 000 | 1 | 161 500 | -5.0 |
| Egypt | 7 | 452 000 | 8 | 489 203 | 8.2 |
| Iraq | 7 | 318 500 | 8 | 318 500 | - |
| Jordan | 1 | 100 000 | 1 | 100 000 | - |
| Kuwait | 4 | 628 000 | 4 | 817 000 | 30.1 |
| Lebanon | 2 | 37 000 | 2 | 37 000 | - |
| Oman | 1 | 76 932 | 1 | 76 932 | - |
| Qatar | 1 | 62 000 | 1 | 62 000 | - |
| Saudi Arabia | 7 | 1 375 000 | 7 | 1 375 000 | - |
| Syrian Arab Republic | 2 | 228 790 | 2 | 243 744 | 6.5 |
| United Arab Emirates | 2 | 180 000 | 2 | 180 000 | - |
| Yemen | 1 | 10 000 | 1 | 10 000 | - |
| Total ESCWA | 37 | 3 888 222 | 39 | 4 113 879 | 5.8 |

Source: Oil and Gas Journal, various issues.

Note: The Rabigh Refinery is scheduled to begin operating in 1989, which will raise Saudi Arabia's total capacity to 1,815,000 b/d.

^{1/} Petroleum Economist, vol. LVI, No. 1 (January 1989), p. 30.

^{2/} Petroleum Intelligence Weekly, vol. XXVIII, No. 1 (2 January 1989), p. 9.

^{3/} Ibid., No. 13 (27 March 1989), pp. 9-10.

Kuwait's refining production capacity increased by 30 per cent during 1988 as a result of a \$2.14 billion expansion and modernization programme undertaken during the 1980s.^{1/} The capacity of Kuwait's Mena Abdullah refinery increased from 75,000 b/d to 200,000 b/d. As a result of this expansion and previous efforts, Kuwait now has the capacity to export 66 per cent of its crude oil output as refined products.^{2/}

Saudi Arabia produces petroleum products both for its domestic market and for export. Saudi Arabia's capacity to export petroleum products will increase by 75 per cent when the Rabigh refinery is inaugurated in 1989.^{3/} The Rabigh refinery was actually completed in 1985, but operations were delayed until marketing prospects could be explored.^{4/} The purchase of refineries in the United States also increased Saudi Arabia's world refining capacity, though only domestic capacity is shown in table 8.

Saudi Arabia continued its efforts to reorganize its oil industry during 1988, and the General Petroleum and Mineral Organization (PETROMIN) was charged with most petroleum product activities.^{5/} In January 1989 a new company, the Saudi Arabian Refining and Marketing Company (SAMARIC), was established to handle Petromin's refining interests.^{6/} PETROMIN, in effect, has become a holding company of SAMARIC. These changes are part of Saudi Arabia's overall restructure of its oil industry which includes the takeover of the Arabian American Oil Company (ARAMCO).

Plans exist in the ESCWA region to construct new refineries and to expand existing refineries. Table 9 illustrates the construction and expansion activities undertaken by the countries of the region.

Table 9. ESCWA refinery construction and expansion activity, 1988

| Country | Capacity (thousands of tons/year) | Probable completion date | Status |
|--------------|-----------------------------------|--------------------------|------------------------------|
| Egypt | 2 500 | 1990 | Expansion of Suez Refinery |
| Iraq | 7 000 | 1991 | New refinery in central area |
| Saudi Arabia | 16 250 | 1989 | New Rabigh refinery |

Source: Martin Quinlan, "Recent profits trend short-lived", Petroleum Economist, vol. LV, No. 9 (September 1988), p. 292.

^{1/} Memo, vol. 13, No. 4 (16 March 1989), p. 6.

^{2/} Ibid.

^{3/} Memo, vol.13, No.4 (16 March 1989), p. 6.

^{4/} Arab Oil and Gas, vol. XVIII, No. 419 (1 March 1989), p. 35.

^{5/} Ibid.

^{6/} Ibid.

D. Oil transport in the ESCWA region

The ESCWA region relies on three major modes of transportation for carrying its oil: pipelines, tankers and trucks. In addition, the Suez Canal provides a convenient route from the Red Sea area to the Mediterranean for the transport of many goods, including some of the region's oil. Major developments during 1988 included actual and plans for improvements to the pipeline system and a general prosperity for the region's modest tanker fleet.

1. Overland systems of transport in the ESCWA region:

The region's export-oriented pipeline system had a capacity of 7.2 million b/d by the end of 1988. There are major pipelines in Saudi Arabia, Iraq, Oman, Yemen and Egypt.^{1/} Current capacity levels were recently enhanced by Saudi Arabia's expansion of Petroline to carry up to 3 million b/d. Total oil production in the region amounted to 12.88 million b/d during 1988, thus existing pipelines have the capacity to facilitate the export of 50 per cent of the region's oil production, though excess capacity does exist and the actual amount of oil carried by pipelines is less.^{2/}

There are plans to increase pipeline capacities. Construction is in progress in Iraq, Oman, Yemen and Democratic Yemen on projects that are expected to be completed in 1989 and 1990. These newly constructed pipelines and the expansion of existing ones are expected to increase the region's export capacity by 2.74 million b/d.^{3/} By 1990 the ESCWA region will be able to export almost 10 million b/d of oil via pipelines.^{4/} Table 10 shows the capacity of the region's export pipelines in 1988 and planned increases by country.

Democratic Yemen has begun construction of a pipeline to transport oil from the Shabwah field to the Bir Ali terminal on the Gulf of Aden.^{5/} The 116 mile line is being financed by the Soviet Union and will be completed in early 1990. Democratic Yemen is also planning an internal line to the Aden refinery from Bir Ali.^{6/} At present, the oil is transported by truck.

1/ Arab Oil and Gas, vol. XVIII, No. 418 (16 February 1989), p. 27.

2/ United States General Accounting Office, Energy Security, an Overview of the Changes in the World Oil Market (Washington, D.C., August 1988), pp. 34-36.

3/ Arab Oil and Gas, vol. XVIII, No. 418 (16 February 1989), p. 27.

4/ Ibid.

5/ Petroleum Intelligence Weekly, vol. XXVII, No. 42 (17 October 1988), p. 8.

6/ Petroleum Economist, vol. LV, No. 7 (July 1988), p. 244.

Table 10. ESCWA region export pipeline capacity, 1988-1990

(Millions of b/d)

| Country | 1988 Actual capacity | Under construction | 1990 Total capacity | |
|------------------|-------------------------|-----------------------|------------------------|-------------|
| Democratic Yemen | | Shubwah-Bir Ali | 0.25 | 0.25 |
| Egypt | 1.60 | | | 1.60 |
| Iraq | 1.50 | Iraq-Turkey Expansion | 0.50) | |
| | | Iraq-Yanbu | 1.65) | |
| | | Iraq-Batman | 0.07) | 3.72 |
| Oman | 0.68 | Expansion | 0.07 | 0.75 |
| Saudi Arabia | 3.26 | | | 3.26 |
| Yemen | 0.20 | Expansion | 0.20 | 0.40 |
| Total | 7.24 | | 2.74 | 9.98 |

Source: Arab Oil and Gas, vol. XVIII, No. 418 (16 February 1989), p. 27.

Iraq has an ambitious programme to expand its pipeline system in the region. By 1990 its pipeline system export capacity will surpass that of Saudi Arabia, as is shown in table 10. Iraq started relying on overland transport systems during the 1980s when hostilities in the region made shipping more difficult. Currently, the development of its system is an important part of its post-war construction programme, and a contract was awarded in November 1988 for the purchase of 140,000 tons of pipe.^{1/} Details of pipeline construction projects currently under way in Iraq are given in table 10. Iraq recently announced that it is abandoning the Iraqi-Syrian pipeline, which has been closed since 1983, as an export pipeline.^{2/} Iraq has also reduced exports by truck via Jordan and Turkey by 90,000 b/d in order to comply with its OPEC quota.^{3/} Iraq is expected to make less use of trucks as its pipelines become operational.

Oman and Yemen are also expanding their existing oil pipelines and this will increase their export capacities by 70,000 b/d and 200,000 b/d respectively.

1/ Arab Oil and Gas, vol. XVIII, No. 419, (1 March 1989), p. 9.

2/ Petroleum Intelligence Weekly, vol. XXVIII, No. 3 (16 January 1989). p. 8.

3/ Arab Oil and Gas, vol. XVIII, No. 416, (16 January 1989).

2. Water transport of oil in the ESCWA region

Shipping has historically been the most important export route for the region's international oil sales. During 1988 the tanker industry performed well world-wide owing to the cessation of hostilities between Iraq and Iran and the increase in the supply, and thus transport, of oil during the latter part of 1988. In fact, the tanker industry performed better than at any time since the early 1970s.^{1/} Expectations of higher spot tanker rates are providing an incentive for oil companies to engage in long-term shipping arrangements, as well as outright purchases of tankers.^{2/}

Table 11 shows the changes in the ESCWA region's tanker fleet between 1987 and 1988. Though table 11 shows a slight decrease in the size of the total fleet, some tankers were re-registered under foreign flags during the Iraq-Iran hostilities but are still owned by regional interests. Kuwait, though showing a loss of dead weight tonnage (DWT) in table 11, recently took delivery of a 35,000 DWT product carrier as part of a larger order of five vessels.^{3/} The decline in Kuwait's fleet results from the reflagging of ships during the Iraq-Iran hostilities for protection purposes. Kuwait has also agreed to lease tankers from the Soviet Union. Increases in tanker fleet size occurred in Iraq and the United Arab Emirates during 1988 as well.

Table 11. ESCWA region tanker fleet 1987 and 1988*

| Country ^{a/} | 1987 | | 1988 | | Percentage change in DWT | Percentage change of world total |
|-----------------------|--------|-----------|--------|-----------|--------------------------|----------------------------------|
| | Number | DWT | Number | DWT | | |
| Egypt | 7 | 443 488 | 7 | 443 488 | 0.00 | 0.18 |
| Iraq | 15 | 1 369 474 | 16 | 1 405 230 | 2.61 | 0.58 |
| Kuwait | 11 | 504 684 | 9 | 418 396 | 17.10 | 0.17 |
| Lebanon | 2 | 38 212 | 1 | 20 880 | 45.36 | 0.01 |
| Qatar | 2 | 197 637 | 2 | 197 637 | 0.00 | 0.08 |
| Saudi Arabia | 25 | 3 110 458 | 24 | 2 711 97 | -12.81 | 1.11 |
| United Arab Emirates | 13 | 696 306 | 15 | 728 707 | 4.65 | 0.30 |
| Yemen | 1 | 400 219 | 1 | 400 219 | 0.00 | 0.16 |
| Total | 76 | 6 760 478 | 75 | 6 326 554 | -6.42 | 2.60 |

Source: World Tanker Fleet Review, 1988, various issues.

* 10,000 DWT and over, end of year figures.

^{a/} By flag of registration.

^{1/} Petroleum Intelligence Weekly vol. XXVIII, No. 12 (20 March 1989), p. 7.

^{2/} Ibid.

^{3/} See Petroleum Intelligence Weekly, vol. XXVII, No. 36 (5 September 1988), p. 8.

Other water transport developments in the ESCWA region in 1988 include an allocation of \$US 900 million by Iraq for the development of its Gulf ports.^{1/} The first project for the construction of jetties at Um Qasr is already under way, and a floating dock for ship repairs together with unloading berths are planned at Khor al-Zubair.^{2/} Shipping lanes leading to the Gulf will also be widened.

Egypt proposes to widen the Suez Canal to allow access to tankers of up to 260,000 DWT.^{3/} The Arab Fund for Social and Economic Development has provided \$US 2 million for a feasibility study on the project, which is expected to cost \$US 1 billion.

^{1/} Arab Oil and Gas, vol. XVIII, No. 416 (16 January 1989), pp. 14-15.

^{2/} Ibid.

^{3/} Ibid., p. 21.

II. RECENT DEVELOPMENTS IN THE ESCWA REGION GAS INDUSTRY

A. The ESCWA region and the international gas market

The ESCWA region participates to some extent in the international gas market through sales of liquefied natural gas (LNG) and liquefied petroleum gas (LPG), mainly to Japan. Its position in the gas market is quite different from that in the oil market since, though ESCWA gas reserves are significant, the region holds a much smaller share of the world's total reserves. The gas market itself is much more competitive at the international level, and to a certain extent high transport costs make participation in the international gas market a function of location. The ESCWA region, however, has the potential to become a significant supplier of natural gas internationally. Its reserves make up 18 per cent of total world reserves and 29 per cent of the market economies' reserves, as is shown in table 13. The largest reserves are found in Iraq, Qatar, Saudi Arabia and the United Arab Emirates.

The international trade of gas has risen and is expected to continue to increase, along with gas consumption in general. One forecast predicts that natural gas consumption will reach 22 per cent of total world energy consumption by the year 2000.^{1/} This compares favourably with the present-day level of 20 per cent and may provide opportunities for the international marketing of gas from the ESCWA region. Indeed, the international trade of gas is expected to increase from 251 billion cubic meters (cu m) in 1987 to 370 billion cu m in the year 2000, and 625 billion cu m by 2020.^{2/} The most notable recent example of the growth in international gas trade is the export of gas to Europe by the Soviet Union and Algeria.

Opportunities exist for ESCWA countries with large gas reserves to export to Europe and/or to the Far East. Qatar, with its large North Field reserves and limited domestic market, has the potential to develop its gas for export. It is currently exploring marketing prospects to justify committing the large capital outlays required for the development of these reserves.

LPG is currently exported from the ESCWA region mainly to Japan. Table 12 shows the average export price levels of ESCWA region LPG sold to Japan in 1987 and 1988. The United Arab Emirates also exports natural gas to Japan.

^{1/} S. Cornot and M. Valais, "World-wide natural gas trade consumption to continue growth", Oil and Gas Journal, 6 June 1988, pp. 33-38. Also see Akhiko Nishiyama, "The rise and background of new gas contracts in the Western European market", Japanese Institute of Middle Eastern Economics Review, No. 3 (Autumn, 1988).

^{2/} S. Cornot and M. Valais, loc. cit.

Table 12. ESCWA region LPG exports price charged to Japan, 1987 and 1988

(Cents/gallon)

| Country | 1987 | 1988 |
|----------------------|------|------|
| Kuwait | 29.6 | 31.6 |
| Saudi Arabia | 31.3 | 32.5 |
| United Arab Emirates | 31.5 | 32.0 |

Source: International Crude Oil and Product Prices, January 1989, (Cyprus 1989), p. 144.

Note: 1988 figures are for January through September.

Exports of natural gas from Iraq to Kuwait continued during 1988 and were facilitated by the doubling in capacity of the pipeline. Egypt will also be in a position to export natural gas in 1989 as a result of increases in production levels, though potential customers have not yet been identified.^{1/} Other developments in 1988 include the financing of phase I of Qatar's North Field development programme.^{2/} Although phase I itself is aimed at production for the domestic market, later phases are expected to produce LNG for export to the Far East and Europe.^{3/} The president of Japan's United Petroleum Development Company recently expressed interest in purchasing LNG from Qatar.^{4/} In order to satisfy expected increases in Japanese demand for gas, about 6 million tons a year could be purchased, depending upon the terms of such an agreement.

B. ESCWA region natural gas reserves, production and consumption levels

ESCWA region gas reserves grew by 15.6 per cent during 1988 following the discovery of new fields and the positive reassessment of existing reserves. Table 13 shows the ESCWA region's gas reserves by country for 1987 and 1988.

^{1/} Arab Oil and Gas, vol. XVIII, No. 416 (16 January 1989).

^{2/} Petroleum Economist, vol. LV, No. 12 (December 1988), p. 393 and Arab Oil and Gas, vol. XVIII, No. 416 (16 January 1989), p. 16.

^{3/} Petroleum Economist, vol. LV, No. 1 (January 1988), p. 27 and Oil and Gas Journal, 25 July 1988, p. 40.

^{4/} Memo, vol. 13, No. 4 (16 March 1989), p. 5.

Table 13. ESCWA region gas reserves, 1987 and 1988

(Billions of cubic metres)

| Country | 1987 | 1988 | Percentage change |
|--------------------------------|--------|--------|-------------------|
| Bahrain | 195 | 190 | -2.7 |
| Egypt | 289 | 325 | 12.4 |
| Iraq | 744 | 2 690 | 261.6 |
| Jordan | - | 28 | |
| Kuwait | 1 206 | 1 378 | 14.2 |
| Oman | 269 | 272 | 1.1 |
| Qatar | 4 435 | 4 437 | 0.1 |
| Saudi Arabia | 4 135 | 4 304 | 4.1 |
| Syrian Arab Republic | 42 | 372 | 785.2 |
| United Arab Emirates | 5 759 | 5 706 | -0.9 |
| Yemen | 45 | 156 | 246.1 |
| Total ESCWA | 17 119 | 19 798 | 15.6 |
| Percentage of market economies | 26 | 29 | |
| Percentage of world | 16 | 18 | |

Source: Oil and Energy Trends, vol. 14, No. 5 (May 1988) and Oil and Gas Journal, 26 December 1988; 1988 Yemen figures from Petroleum Intelligence Weekly, vol. XVII, No. 42 (17 October 1988), p. 8.

Note: Year end figures.

Changes in ESCWA gas reserves on a country by country basis ranged from 2.7 per cent in Bahrain to 785.2 per cent in the Syrian Arab Republic. Iraq and Yemen also recorded significant increases in gas reserves of 261.6 per cent and 246.1 per cent respectively. ESCWA region gas reserves now account for 29 per cent of the market economies' reserves and 18 per cent of the world's reserves, an increase over 1987 levels.

Marketed gas production by country in the ESCWA region for 1987 and 1988 is shown in table 14. Gas production in most ESCWA countries fell during 1988, with decreases ranging from 7.4 per cent in Saudi Arabia to 14 per cent in Bahrain. The decreases occurred mainly in GCC countries, though oil output levels increased and a significant portion of their gas reserves are associated. Increases in production of 15.2 per cent and 2.5 per cent occurred respectively in Egypt and Oman.

The gas processing facilities that were available in 1988 in the ESCWA region are listed in table 15. Table 15 shows that average throughput at the beginning of 1988 was at or near capacity levels in most of the ESCWA countries that have processing facilities. The products produced include propane, butane and LPG.^{1/}

^{1/} Oil and Gas Journal, 11 July 1988, p. 44.

Table 14. ESCWA region marketed gas production, 1987 and 1988

(Millions of cubic metres)

| Country | 1987 | 1988 | Percentage change |
|----------------------|--------|--------|-------------------|
| Bahrain | 6 130 | 5 267 | -14.08 |
| Egypt | 6 280 | 7 235 | 15.21 |
| Iraq | 3 740 | .. | |
| Kuwait | 5 300 | 4 870 | -8.10 |
| Oman | 2 260 | 2 067 | -8.53 |
| Qatar | 5 610 | 5 748 | 2.47 |
| Saudi Arabia | 26 800 | 24 806 | -7.44 |
| Syrian Arab Republic | .. | 693 | |

Source: OPEC Annual Statistical Bulletin, 1987, and Arab Oil and Gas, vol. XVIII, No. 419 (1 March 1989), p. 41.

Table 15. Gas processing facilities in the ESCWA region, 1988

| Country | Plants | Millions of cubic feet/day | |
|----------------------|--------|----------------------------|----------------|
| | | Gas capacity | Gas throughput |
| Bahrain | 1 | 168 | 155 |
| Egypt | 9 | 1 449 | 1 339 |
| Kuwait | 1 | 560 | 448 |
| Oman | 8 | 626 | 309 |
| Qatar | 2 | 579 | 229 |
| Saudi Arabia | 5 | 4 300 | .. |
| United Arab Emirates | 8 | 2 922 | 2 559 |
| Total | 34 | 10 604 | |

Source: Oil and Gas Journal (11 July 1988), p. 44.

Note: As of 1 January 1988.

Egypt's gas reserves increased by 12.4 per cent during 1988, partly as a result of new discoveries including those in the western desert. Egypt is pursuing an energy strategy of using gas for domestic consumption to free oil for export. Gas consumption has grown significantly in the recent past and in 1987 Egypt consumed 6,793.7 million cu m.^{1/} By 1990 gas consumption is expected to reach 24 per cent of total energy consumption in Egypt.^{2/} Egypt

1/ Oil and Gas Journal, 11 July 1988.

2/ Arab Oil and Gas, vol. XVIII, No. 417 (1 February 1989), p. 43.

has successfully developed a gas-gathering system which has contributed to a rapid increase in marketed gas production. In 1987-1988, Egypt's production of natural gas, condensate and LPG amounted to 62.3 million barrels of oil equivalent, more than three times that produced in 1980-1981.^{1/} Egypt has both associated and non-associated gas reserves located in three main areas, the Mediterranean basin, the western desert and the Gulf of Suez. Current development plans are focusing on recent discoveries in the western desert. The development of three recent discoveries is expected to yield about 55 million cubic feet (cu ft) per day of natural gas, 25 million cu ft/day of associated gas and 2,500 b/d of condensate.^{2/}

The development of a domestic gas grid is an important part of Iraq's reconstruction plan which appears to reflect a change in its previous plan to promote gas exports.^{3/} Gas produced in the south of Iraq is to be used in power plants, industries and refineries in central Iraq. Iraq's reserves increased substantially during 1988 as a result of new discoveries and a reassessment of existing reserves. Iraq's natural gas reserves consist mainly of associated gas.

Kuwait's gas reserves increased modestly during 1988. Kuwait's reserves are largely associated and its production levels depend on oil production levels. Preliminary production figures shown in table 14 indicate that Kuwait's production of natural gas fell during 1988 by a little more than 8 per cent to 4,870 million cu m. Kuwait continues to import natural gas from Iraq. The decline in production is surprising, since oil output levels increased and most of Kuwait's gas is associated gas.

Oman's reserve level rose slightly during 1988, as is shown in table 13 and further increases are expected from ongoing exploration. Gas production, however, fell by 8.5 per cent. Most of Oman's gas reserves are associated. Non-associated gas has been found offshore in the Bukha field but it has not yet been exploited. Some associated gas, about 35 million cu ft/day is still flared. Oman's exploitation of its natural gas reserves is hampered by the relatively small local market and the fact that its reserves are scattered in many small fields.^{4/} It is attempting to overcome these problems by developing mobile offshore processing facilities and in late September 1988 it purchased a large oil tanker (VLCC) for conversion to a floating methanol plant.^{5/}

Qatar's gas production rose slightly during 1988 by 2.5 per cent to 5,748 million cu m. Qatar currently produces gas for its domestic market and for export to Japan. Its major reserves are in the form of non-associated gas, which are located in the North Field. Though discovered in the early 1980s,

^{1/} Arab Oil and Gas, vol. XVIII, No. 417 (1 February 1989).

^{2/} Petroleum Economist, vol. LV, No. 10 (October 1988), p. 344.

^{3/} Ibid., p. 324.

^{4/} Ibid., vol. LV, No. 11 (November 1988), p. 378.

^{5/} Ibid.

the development of this field has been delayed. Financing for the first phase of the development project was recently obtained and the purchasing of equipment has begun.^{1/} Phase I of the development project will provide gas for the domestic market. This phase of the project, which will cost \$US 950 million, will have a capacity of 800 million cu ft/day; it is expected to be completed by 1991.^{2/}

Saudi Arabia's gas reserves increased by a modest 4.1 per cent during 1988, while production decreased over 7 per cent. Saudi Arabia uses most of its gas domestically. Its master gas system was designed to provide gas to local consumers and to eliminate the wasteful flaring of associated gas. Most of Saudi Arabia's reserves are associated. Saudi Arabia also exports LPG to Japan.

Syrian gas reserves increased considerably during 1988 as a result of new discoveries. The 785 per cent increase shown in table 13 is the highest in the ESCWA region. The Syrian Arab Republic is adopting a policy similar to Egypt's policy of encouraging domestic gas consumption to free more oil for export.^{3/} Though its estimated 1988 production was rather modest (693 million cu m), production is expected to increase. One project being undertaken by Marathon Oil near Homs on a production sharing basis is expected to produce 100 million cu ft/day of gas by 1990.^{4/}

The United Arab Emirates experienced a minor decrease in reserves during 1988 and output levels decreased by 13.8 per cent. The United Arab Emirates produces gas for sale on the international market and for local consumption.

Yemen's gas reserves increased by 246 per cent during 1988 as a result of a reassessment of previously discovered fields. A recent study recommended that Yemen should utilize its gas to satisfy the growing domestic energy demand and allow more oil to be exported.^{5/} LPG production facilities are expected to be completed by 1990, but further investments will be required to meet LPG demand by the mid 1990's.^{6/} The study recommended that dry gas be used in power plants, while LPG should be reserved for residential and industrial use.

^{1/} Petroleum Economist, vol. LV, No. 12 (December 1988), p. 393 and ibid., vol. LVI, No. 2 (February 1989), p. 70. Qatar will set aside 30,000 b/d of oil to service this debt. See Petroleum Intelligence Weekly, vol. XXVII, No. 46 (14 November 1988), p. 8.

^{2/} Oil and Gas Journal, 25 July 1988, p. 40.

^{3/} Arab Oil and Gas, vol. XVIII, No. 415 (1 January 1989), p. 20.

^{4/} Ibid.

^{5/} Petroleum Economist, vol. XXVII, No. 42 (17 October 1988), p. 8.

^{6/} Ibid.

C. Gas transport in the ESCWA region

The transportation of gas in the ESCWA region is carried out by trucks, pipelines and shipping. Most gas is consumed within the producing country and transport networks are geared toward local markets. In fact the high cost of transporting gas is a major factor inhibiting the rate of growth of ESCWA gas exports. Qatar, for instance, with its large untapped gas reserves, must solve a number of difficult transportation problems if it is to export gas to Western Europe and the Far East. Some developments took place in the region during 1988 in the area of gas transport, mainly the producing countries.

Gas transport systems rely heavily on pipelines. As gas use increases in both absolute terms and as a share of total energy use, pipeline construction is expected to increase. Pipelines are also preferred to other modes of gas transport for environmental reasons.^{1/} In the ESCWA region gas transport system during 1988 developments have focused on expanding pipeline systems within national borders.

Construction began in Egypt on a trunk-line to link the recently discovered gas in Badr al-Din to a petrochemical complex west of Alexandria.^{2/}

The most ambitious pipeline system under construction in the ESCWA region is in Iraq, where construction of a major gas grid to take gas produced in the south to power stations and to a planned refining/petrochemical complex south-west of Baghdad.^{3/} A contract was recently awarded to a Soviet Union firm for the construction of a 31-kilometer gasline between Rumaila and Musayyeb.^{4/} A 170-kilometre parallel pipeline from Iraq to Kuwait was expanded in 1988, which facilitated the construction of an intercountry gasline in the ESCWA region.

Qatar has plans to develop gaslines as part of its plan for developing the North Field. Phase I which will supply gas to the domestic market has just begun; phases II and III, which will respectively supply gas to other GCC countries and to countries outside the region, will entail the use of pipelines for gas transport.

The ESCWA region holds large reserves of gas. Energy demand, including the demand for gas, is growing and is expected to continue to grow.^{5/} The utilization of gas depends to a large extent on the gas transport infrastructure. Though gas transport systems in the region have been limited to systems within natural borders, it would be possible to develop a region-wide gas grid, and in order to meet the growing energy demand within the region, this should be explored by member States.

^{1/} Alessandro Andreani, "Pipeline construction seen expanding", Oil and Gas Journal, 26 September 1988, p. 41.

^{2/} Petroleum Economist, vol. LV, No. 10 (October 1988), p. 346.

^{3/} Ibid., p. 326.

^{4/} Arab Oil and Gas, vol. XVIII, No. 415 (1 January 1989), p. 9.

^{5/} Petroleum Intelligence Weekly, vol. XXVII, No. 51 - 52 (19 December 1988), p. 5.

III. OIL AND GAS EXPLORATION IN THE ESCWA REGION

Exploration activities in the field of oil and gas suffered world-wide during 1988 owing to fluctuating oil prices and the high costs associated with exploration. Fluctuating oil prices causes uncertainty with regard to long-term prices, and a high price is needed to cover exploration and development costs. These factors particularly inhibited exploration efforts in countries with high operating costs where there is no geological evidence of major new fields, such as in the United States.

Most exploration activities during 1988 took place in developing countries where operating costs are expected to be lower and where there is also the incentive to earn hard currency from exports, or at least to save hard currency payments for energy imports. Exploration activities in the ESCWA region continued during 1988 in countries which had no oil reserves but where there was some geological evidence of the possibility of increasing oil reserves, such as Egypt, the Syrian Arab Republic and Yemen. Exploration activities are usually undertaken by foreign oil companies on a production-sharing basis. This type of arrangement offers advantages to the country in question in that the latest technology is utilized and there is no financial risk if commercially-viable reserves are not found.

Table 16. Active rigs in the ESCWA region, 1987 and 1988

| | 1987 | | | 1988 | | |
|--|---------|----------|-------|---------|----------|-------|
| | Onshore | Offshore | Total | Onshore | Offshore | Total |
| Democratic Yemen | 0 | 0 | 0 | 0 | 0 | 0 |
| Bahrain | 0 | 0 | 0 | 0 | 0 | 0 |
| Egypt | 11 | 13 | 24 | 8 | 15 | 23 |
| Iraq | 18 | 0 | 18 | 27 | 0 | 27 |
| Jordan | 3 | 0 | 3 | 2 | 0 | 2 |
| Kuwait | 6 | 0 | 6 | 5 | 0 | 5 |
| Oman | 10 | 0 | 10 | 10 | 0 | 10 |
| Qatar | 1 | 0 | 1 | 1 | 3 | 4 |
| Saudi Arabia | 3 | 1 | 4 | 4 | 1 | 5 |
| Syrian Arab Republic | 25 | 0 | 25 | 31 | 0 | 31 |
| United Arab Emirates | 2 | 7 | 9 | 4 | 8 | 12 |
| Yemen | 0 | 0 | 0 | 0 | 0 | 0 |
| Total ESCWA region | 71 | 21 | 100 | 92 | 27 | 119 |
| Total world | 1 962 | 384 | 2 346 | 1 578 | 376 | 1 954 |
| ESCWA share of world total (percentage) | 4.03 | 5.47 | 4.26 | 5.83 | 7.18 | 6.09 |

Source: Oil and Energy Trends, vol. XIV, No. 4 (21 April 1989).

Table 16 shows that exploration and development activities did not follow the world-wide trend towards decline in 1988, as the number of active rigs in the ESCWA region increased slightly. There were significant increases in the number of active rigs in Iraq, Saudi Arabia and the United Arab Emirates.

Exploration efforts met with success in the ESCWA region during 1988. Table 17 shows oil and gas discoveries in ESCWA countries in 1987, 1988 and the first part of 1989.

Table 17. Oil and gas discoveries in the ESCWA region, 1987-1989

| | Oil | | | Gas | | |
|----------------------|------|------|-------|------|------|--------------------|
| | 1987 | 1988 | 1989* | 1987 | 1988 | 1989 ^{a/} |
| Yemen | 1 | | | | | |
| Egypt | 21 | 3 | 3 | 1 | 1 | |
| Jordan | | | | 2 | | |
| Oman | 1 | 5 | | | | |
| Syrian Arab Republic | | 1 | | | | |
| United Arab Emirates | | | | | 1 | |

Source: Oil and Energy Trends, various issues and Arab Oil and Gas, vol. XVII, No. 400 (16 May 1988), p. 16.

Note: Reported discoveries only. Discoveries may not be commercially viable.

^{a/} January-April 1989.

Encouraged by discoveries in Yemen close to its border, Democratic Yemen began to encourage foreign exploratory activities in the mid-1980s. Oil was discovered in Democratic Yemen in 1987 and exploratory efforts continued during 1988. Current exploratory activities are being undertaken by British, French and Soviet firms and include seismic surveys and drilling. Iraq has also agreed to send Iraqi oil experts to Democratic Yemen and to provide training. Geologists are optimistic about the prospects of finding oil in Democratic Yemen and believe that production could eventually reach 500,000 b/d.^{1/} An agreement was also reached during 1988 with Yemen over the previously disputed border area of about 2,200 square kilometres.^{2/} A joint venture between the two countries, the Yemen Company for Investment in Oil and Mineral Resources, has been established and foreign participation in exploration is being sought.^{3/}

Egypt continued its policy of actively encouraging exploration for oil and gas during 1988. Exploration agreements were made with foreign oil companies to cover areas in the Gulf of Suez, the western desert and the Nile delta. The number of drilling rigs increased during 1988 and Egypt plans to

^{1/} Petroleum Intelligence Weekly, vol. XXVII, No. 47 (21 November 1988), p. 8.

^{2/} This area is located between the Shabwah field in Democratic Yemen and the Marib field in Yemen.

^{3/} Middle East Economic Digest, vol. 33, No. 12 (31 March 1989), p. 24.

add more in 1989.^{1/} Significant discoveries were made in the Gulf of Suez during 1988 by the Gulf of Suez Petroleum Company, the International Egyptian Petroleum Company and Conoco.^{2/} The fact that these discoveries were made over a wide area of the Gulf of Suez has reaffirmed the potential of the Gulf of Suez as a major source of yet undiscovered reserves. The Gulf of Suez produces more than two thirds of Egypt's total oil output.^{3/}

Though the western desert provides only a fraction of Egypt's total oil output, its share has increased and Egypt is encouraging exploration in this area.^{4/} Experts are confident that more oil will be found in this area, though there are differences of opinion concerning the likely size of potential discoveries. Egyptian officials believe that the full potential of the western desert will be known within the next few years. Output from the western desert was 54,600 b/d in mid-1988, and there are plans to increase this to 74,000 b/d by 1990.^{5/}

A third area in Egypt which is attracting interest is the Nile delta. This area is considered to be a likely area for gas discoveries and Egypt's revised gas clause has helped to encourage exploration in this area.^{6/} The Egyptian General Petroleum Company awarded three concessions in the Nile delta area in late 1988 to foreign companies in the expectation of finding gas deposits.^{7/}

Iraq has announced new gas discoveries as a result of its intensive 20-year exploration programme. Thirteen fields with associated gas were found along with seven gas fields.^{8/} Gas reserves have increased considerably as a result of recent discoveries to 300 billion cu m of non-associated gas.^{9/} Iraq has approached foreign companies to continue exploration activities, but on a contract rather than equity basis.^{10/}

^{1/} Arab Oil and Gas, vol. XVIII, No. 419 (1 February 1989), p. 20.

^{2/} Petroleum Economist vol. LV, No. 8 (August 1988), p. 273.

^{3/} Ibid.

^{4/} Oil and Gas Journal, 20 June 1988, p. 38.

^{5/} Ibid.

^{6/} Egypt revised its gas clause in 1987 to include terms that were more attractive for foreign exploration companies.

^{7/} Petroleum Economist, vol. LV, No. 12 (December 1988), p. 421.

^{8/} Oil and Gas Journal, 6 June 1988, p. 16.

^{9/} Petroleum Economist, vol. LV, No. 7 (July 1988), p. 246.

^{10/} Ibid.

Jordan continued its exploration efforts in 1988, despite the previous lack of success in finding economically-viable deposits. A joint exploration and seismic survey is being carried out by the Natural Resources Authority and Canada in several locations, including the Rishda area, where some gas was discovered in 1987.^{1/} The Petro-Canada International Assistance Corporation is interpreting seismic and well data, as well as conducting seismic surveys in unexplored areas of Jordan.^{2/} Similar agreements to explore various parts of the country have also been made with Austria and Japan.^{3/}

The agreements with Austria and Japan call for exploration activities to be undertaken in the south, including seismic surveys and drilling activities.^{4/} A Romanian firm has also been awarded a contract to drill delineation wells near the Rishda gas discovery. Jordanian officials expected Amoco, Hunt Oil and BP, which hold exploration licences, to begin drilling operations in early 1989.^{5/}

Exploration activities continued in Oman during 1988. They were carried out by various foreign firms, as well as by Petroleum Development Oman (PDO). Exploration is a high priority in Oman and discoveries made in the 1980s are being developed rapidly. In 1989 PDO drilled 25 exploratory wells, while foreign companies drilled three wells.^{6/} Foreign companies also carried out seismic work in onshore as well as offshore areas of Oman. New discoveries of light and heavy crude were announced in December 1988, including the Al-Huwaisah field, 300 kilometers south of Muscat.^{7/} PDO also made five discoveries, largely of heavy oil, in the central and southern parts of the country.^{8/} PDO has taken over exploration activities in offshore acreage in the Arabian Sea, which were previously carried out by foreign companies.^{9/} Oman hopes that its discoveries will replace oil currently being depleted.

^{1/} Arab Oil and Gas, vol. XVIII, No. 416 (16 January 1989).

^{2/} Ibid., No. 415 (1 January 1989).

^{3/} Middle East Economic Digest, vol. 33, No. 13 (7 April 1989), p. 29.

^{4/} Ibid., and Middle East Economic Survey, vol. 32, No. 25 (27 March 1989), p. A15.

^{5/} Arab Oil and Gas, vol. XVIII, No. 416 (16 January 1989).

^{6/} Ibid., p. 17.

^{7/} Ibid.

^{8/} Petroleum Economist, vol. LV, No. 2 (February 1988), p. 63.

^{9/} Ibid., No. 3 (March 1988), p. 93.

Qatar recently awarded offshore exploration rights to the French concern, Elf Aquitaine,^{1/} which hopes to find oil.

The significant increases in Saudi Arabian oil reserves, announced in early January 1989, are in part the result of exploration activities carried out throughout the country.^{2/} Saudi Arabia's Fifth Development Plan (1990-1995), approved in December 1988, gives priority to exploration for mineral wealth.^{3/}

The discovery of the Omar field during 1988 added significantly to the Syrian Arab Republic's oil reserves and provided an incentive to increase exploration activities throughout the country. The Omar field is expected to produce 100,000 b/d. Production was due to begin in early 1989.^{4/} A number of foreign companies which held exploration licences in the Syrian Arab Republic have stepped up their activities. The Syrian Arab Republic granted four major licences to foreign companies in 1988 covering areas totalling 22,025 square kilometres.^{5/} The companies are expected to drill exploratory wells and the agreements are generally on a production-sharing basis. Gas reserves have also been discovered.

Exploration in the United Arab Emirates is undertaken by foreign companies. ARCO is using advanced exploration technology in its attempt to discover reserves near the Margham condensate field in a previously undrilled structure.^{6/}

Intensive exploration activities in Yemen continued during 1988. Exploration acreage has been obtained by many foreign companies. Evaluation of recent discoveries reveal that oil production could exceed 225,000 b/d.^{7/} In fact, Yemen's export capacity will be limited by the constraints imposed by its pipeline, which is being expanded to transport 200,000 b/d. Development and exploration activities have also revealed larger gas reserves.^{8/}

1/ Arab Oil and Gas, vol. XVIII, No. 416 (16 January 1989), p. 15-16.

2/ Ibid., p. 9.

3/ Ibid., p. 12.

4/ Ibid., No. 415 (1 January 1989), p. 14.

5/ Ibid., No. 419 (1 February 1989).

6/ Petroleum Intelligence Weekly, vol. XXVII, No. 42 (17 October 1988), p. 7.

7/ Ibid., No. 46 (14 November 1988), p. 8.

8/ Ibid., vol. XXVIII, No. 6 (6 February 1989), p. 7.

IV. RECENT DEVELOPMENTS IN THE ESCWA REGION ELECTRICITY SECTOR

A. Electricity generation, peak load and installed capacity

Although data for 1988 is currently not available, table 18 reveals that there were increases in installed capacity, electricity generation and in peak loads in many of the countries of the ESCWA region during 1987. In those countries for which data are available, there were significant increases in these three categories as a result of the adoption of policies and activities designed to promote the capacity of electricity generation and production. Providing electricity to rural communities has been a priority in many ESCWA countries.

B. Electrification of rural areas in the ESCWA region

Progress was made in providing rural areas of the ESCWA energy region with electricity during 1988. Iraq has almost completed its rural supply scheme which began in 1975. During 1988, 95 per cent of the population had access to electricity.^{1/} Additional plants are under construction which will, in part, serve rural areas. Jordan, too, has been successful in supplying electricity to rural areas and continued its efforts during 1988. A master plan is currently being drawn up to supply 13 villages with electricity.^{2/} The Social Security Corporation lent 3 million Jordanian dinars (JD) for rural electrification projects which are part of a programme carried out by the Jordan Electricity Authority.^{3/} Oman plans to install a 30 megawatt (MW) extension to the Wadi Jizzi power station, which is the main supplier of electricity to rural areas in the north.^{4/} The plant currently has an installed capacity of 170 MW. The extension is part of a plan for general rural development, which will result in increased demand for electricity in these areas. Saudi Arabia's Public Electricity Corporation will provide 75 remote villages with electricity under a special programme.^{5/} Eight other programmes have already provided many Saudi Arabian villages with electricity. Plans also exist to provide electricity along the Jordan-Medina route and between Riyadh, Qassem and Medina. Yemen's plan for rural electrification, known as Power Four, has experienced some delays owing to financing problems. However, funding was obtained in 1988 from the Swedish Agency for Technical and Economic Co-operation, the International Development Association, the Islamic Development Bank (IDB) and the Arab Fund for Economic and Social Development.^{6/} The \$US 60 million project will provide electricity for rural areas throughout Yemen, and will also include training programmes and technical assistance.

1/ Middle East Economic Digest, vol. 32, No. 18 (6 May 1988), p. 8.

2/ Ibid., No. 1 (2-8 January 1988), p. 14.

3/ Ibid., No. 34 (26 August 1988).

4/ Ibid., No. 26 (1 July 1988), p. 23.

5/ OPEC Bulletin, vol. XX, No. 4 (April 1989), p. 48.

6/ Middle East Economic Digest, vol. 32, No. 15 (9-15 April 1988), p. 35.

Table 18. Electric energy generation, peak load and installed capacity in the ESCWA region, 1986 and 1987

| Country | Electricity generation (gigawatt hours) | | | Peak load (megawatts) | | | Installed capacity (megawatts) | | |
|----------------------|--|--------|-------------------|--------------------------|-------|-------------------|-----------------------------------|--------|-------------------|
| | 1986 | 1987 | Percentage change | 1986 | 1987 | Percentage change | 1986 | 1987 | Percentage change |
| Bahrain | 2 948 | .. | .. | 928 | .. | .. | 1 010 | .. | .. |
| Democratic Yemen | 452 | .. | .. | 89 | .. | .. | 186 | .. | .. |
| Egypt | 33 464 | 36 895 | 10.25 | 5 742 | 6 152 | 7.14 | 8 643 | 8 963 | 3.70 |
| Iraq | 23 300 | .. | .. | 4 560 | .. | .. | 2 600 | .. | .. |
| Jordan | 2 955 | 3 486 | 17.97 | 448 | 516 | 15.18 | 790 | 959 | 21.39 |
| Kuwait | 17 118 | 18 240 | 6.55 | 3 480 | 3 740 | 7.47 | 5 086 | 5 741 | 12.88 |
| Lebanon | 4 170 | .. | .. | 842 | .. | .. | 1 146 | 1 230 | 7.33 |
| Oman | 2 648 | .. | .. | 641 | .. | .. | 988 | 1 232 | 24.74 |
| Qatar | 4 303 | 4 366 | 1.47 | 892 | 907 | 1.68 | 1 621 | 1 743 | 7.53 |
| Saudi Arabia | 36 171 | 39 570 | 9.40 | 10 513 | 10950 | 4.16 | 14 761 | 14 647 | 0.77 |
| Syrian Arab Republic | 7 302 | 7 476 | 2.38 | 1 294 | 1 430 | 10.51 | 2 015 | 2 250 | 11.66 |
| United Arab Emirates | 12 610 | .. | .. | 2 580 | .. | .. | 3 770 | .. | .. |
| Yemen | 606 | .. | .. | .. | .. | .. | 437 | 437 | 0.00 |
| Total | 148 047 | .. | .. | .. | .. | .. | 43 053 | .. | .. |

Source: Compiled from the Economic and Social Commission for Western Asia data bank and national sources.

Note: Two dots (..) indicate that data are not available.

C. Progress made on an ESCWA region electricity grid

During 1988 the region continued its efforts to promote the interconnection of national electricity grids. There has been co-operation in this regard among individual countries during the 1980s. Jordan and the Syrian Arab Republic have co-operated on electricity matters throughout the 1980s, while a project is under way to connect the Jordanian and Egyptian electricity grids. A feasibility study has been prepared which indicates that the project will cost \$US 170 million and take five years to complete. Jordan and Iraq are currently studying the possibilities of interconnecting their grids. There is already an interconnection between Iraq and Turkey and Iraq exported electricity to Turkey in 1988.^{1/}

Representatives from Egypt, Iraq, Jordan, the Syrian Arab Republic and Turkey as well as the IDB and AFESD met in early 1989 to discuss the possibilities of establishing a five-country interconnection.^{2/} A protocol was signed by the five Governments to provide for a feasibility study to be financed by IDB.^{3/} Once implemented, an interconnected grid in this part of the ESCWA region would have the potential to be connected to the proposed GCC electricity grid via a proposed Iraq Kuwait link, as well as the European grid through Iraq's connection with Turkey.

Work has begun on the interconnection of the electricity grids of GCC countries.^{4/} The first phase of the project involves the interconnection of the national grids of Saudi Arabia, Kuwait, Bahrain and Qatar. There are a number of technical difficulties, including the conversion of Saudi Arabia's 60 hertz (HZ) system to provide for interconnection to the grid of the United Arab Emirates and Oman. The final stage of the project will interconnect these two grids to form one subregional grid. The project will cost \$US 1.6 million, which is \$US 1.4 billion less than adding to the capacity of each GCC country on an individual basis.^{5/} The GCC has accepted bids for a consultancy contract to review and update the previous technical and economic study which was completed in 1986. The consultant chosen will also reassess the project, study implementation methods, examine its economic feasibility, study the possible routes, propose possible finance arrangements and draw up a management study.^{6/}

Plans to provide an interconnection between Democratic Yemen and Yemen were discussed in 1988 and financing was secured from the AFESD.^{7/} The \$US 63 million loan will finance an overhead line from Taiz to Aden, with spurs to

1/ Turkey is not a member of ESCWA. Jordan Times, 5 March 1989, p. 3.

2/ Ibid.

3/ Arab Oil and Gas, vol. XVIII, No. 419 (1 February 1989), p. 20.

4/ Ibid., p. 31.

5/ Ibid.

6/ Middle East Economic Digest, vol. 32, No. 32 (12 August 1988), p. 7.

7/ Ibid., No. 44 (4 November 1988), p. 55.

nearby towns and villages. This will enable the more efficient use of surplus electricity, as well as promote co-ordination between the two countries in energy planning in general.

D. ESCWA region electricity projects

Bahrain plans to build a \$US 770 million power and desalination plant. In late 1988 Bahrain discussed financing arrangements with AFESD, the Abu Dhabi Fund for Arab Economic Development and IDB.^{1/} The plants will have an installed capacity of 400 MW, to be completed in phases. The first phase of 160 MW is to be completed by 1992. Demand is expected to grow by 4 per cent per year, and by 1992 additional capacity will be needed.

Other major developments during 1988 included the agreement between Egypt and the Soviet Union on the construction of three power stations in the Sinai at Ayun Moussa, in Upper Egypt at Nag Hammadi and near the Red Sea in El-Galala.^{2/} The plants will have a combined capacity of 1,200 MW. Egypt is interested in building gas and coal-fired power stations to reduce its dependency on hydroelectricity, which has been adversely affected by the relatively low water level of the Nile River.^{3/} Egypt also received a commitment for \$US 120 million from AFESD, which will be used to construct a power plant in Damietta.^{4/} A contract has been awarded to construct a 300 MW extension to the Damietta power station.^{5/}

The fourth 315 MW unit of the Shoubra El-Khaima power station has been completed and was being tested in 1988.^{6/} Work is now under way to install transmission lines for the interconnection system which will facilitate distribution throughout Cairo and the surrounding areas. Egypt has also chosen a site on the Gulf of Suez 60 kilometres south of Suez, for a hydroelectric plant designed to pump sea water to storage basins on high ground. Egypt plans to increase its generation of electric energy to 49,200 gigawatt hours (GWh) by 1992.^{7/} In early 1989 Egypt responded to recommendations made by the International Monetary Fund to reduce subsidies on electricity (together with other items). Recent increases in the price of electricity range from 40

1/ Middle East Economic Digest, vol. 32, No. 46 (18 November 1988).

2/ Arab Oil and Gas, vol. XVIII, No. 417 (1 February 1989). The agreement was actually signed in January 1989.

3/ Petroleum Economist, vol. LV, No. 6 (June 1988), p. 212 and Egypt. Ministry of Planning and International Co-operation, Summary of the Second Five-Year Plan, 1987/88-1991/92, pp. 54-55.

4/ Middle East Economic Digest, vol. 32, No. 43 (28 October 1988), p. 13.

5/ Ibid., No. 47 (25 November 1988), p. 16.

6/ Ibid., No. 38 (23 September 1988), p. 14.

7/ Egypt, Ministry of Planning and International Co-operation, Summary of the Second Five-Year Plan, 1987/88 - 1991/92.

per cent for industrial consumers to 9 per cent for consumers of less than 950 kilowatt hours (kWh) per month.^{1/} The higher prices, however, will only generate revenue to cover 30 per cent of the cost of production.^{2/}

Another important development in the electricity sector of the region in 1988 has been the emphasis placed on electricity by Iraq in its post-war reconstruction scheme. Iraq is especially interested in hydroelectricity and recent reports estimate its potential production at between 67 billion kWh and 90 billion kWh per year.^{3/} Contracts have been awarded to foreign firms to build three new power plants in various parts of the country. The Al-Anbar plant, located on the Euphrates river, 140 kilometres north-west of Baghdad, will have a generating capacity of 1,800 MW and will cost \$US 880 million.^{4/} The Yussifiya plant, located 40 kilometres south-east of Baghdad on the Euphrates river and the Al-Shamal power station, located in the north of Iraq, will add 1,200 MW and 1,400 MW respectively to Iraq's generating capacity, with costs of \$US 770 and \$US 500 respectively. These projects are expected to be completed by 1993 to meet expected increases in local demand as well as to provide surpluses for export to Turkey.^{5/} Construction is under way on the Bekme dam on the Lesser Zab river 120 kilometres from the Tigris River.^{6/} The power plant will have six 250 MW units for generating hydroelectricity. Iraq also plans to build a dam, the Taktak dam, on the Lesser Zab river downstream from the Dokan dam for hydroelectric power purposes.^{7/} Three other sites have also been chosen for new dams, with plans for a hydrological forecasting system, data banks, an aerial observation system and a centre to control hydroelectric output.^{8/} By the year 2000, Iraq's power generation capacity is expected to reach 17,500 MWh.^{9/}

Jordan received financing from the European Investment Bank to extend and improve the Amman and Zarka electricity distribution system.^{10/} The loan is for \$US 16.3 million, and an additional \$US 6.5 million is to be financed by the World Bank. The project will provide three medium voltage distribution substations, 270 kilometres of underground cable, 120 transformer substations and three cable testing vans. Much of Jordan's industry is located in this

^{1/} Middle East Economic Digest, vol. 33, No. 15 (21 April 1989), p. 11.

^{2/} Ibid.

^{3/} Ibid., pp. 13-14.

^{4/} Arab Oil and Gas, vol. XVIII, No. 417 (1 February 1989), p. 11.

^{5/} Ibid.

^{6/} Middle East Economic Digest, vol. 32, No. 38 (23 September 1980), p. 8.

^{7/} Ibid., vol. 33, No. 15 (21 April 1989), p. 13.

^{8/} Ibid.

^{9/} Ibid., vol. 32, No. 18 (6 May 1988), p. 8.

^{10/} Ibid., No. 36 (9 September 1988), p. 32.

area. Jordan is also building the al-Wahdeh dam which will provide hydroelectric power mainly for export to the Syrian Arab Republic.^{1/} Various international sources will finance \$US 260 million of the total \$US 440 million cost of the dam, which will be used for irrigation purposes, as well as for power generation.^{2/}

Progress was made in 1988 on Kuwait's Subiya power station, which will have a capacity of 2,400 MW. The plant will cost between \$US 1,230 million and \$US 1,580 million, and will also include a water desalination facility. Various contracts were awarded during 1988 and the initial start-up is expected to take place by 1991. Kuwait also awarded contracts in 1988 as part of the programme to upgrade and extend its power network.^{3/} Plans include work to be carried out on the Jahra district control system and substations throughout the country for the distribution of electricity.^{4/}

Qatar is undertaking projects aimed at increasing the capacity of its power plants. There are plans to install two gas turbines at the Al-Wajbah and Doha South power plants.^{5/} Plans also exist to expand Doha's distribution network, and a consultant is currently studying Qatar's power system to determine the best way of increasing the capacity to meet expected increases in the demand for electricity, which is increasing by 10 per cent per year.^{6/} Qatar also has plans to build a new 1,500 MW power and water desalination plant at Al-Wusail, but the project is currently being reassessed.

Saudi Arabia's combined power and water desalination plant at Shuqaiq was completed in 1988.^{7/} It has a capacity of 128 MW and should start supplying the area with electricity once the distribution system is completed in 1989. Saudi Arabia also plans to expand the Al-Khobar plant by adding 300 MW to its total capacity. The Qurrayah plant in the eastern province will have its capacity doubled to 2,400 MW by 1989 to meet additional demand in the Riyadh area.^{8/} The transmission capacity is also being increased.

^{1/} Middle East Economic Digest, vol. 32, No. 38 (23 September 1988), p.19.

^{2/} Ibid., No. 42 (21 October 1988), p. 29.

^{3/} Ibid., No. 28 (15 July 1988), p. 31.

^{4/} Ibid., p. 31 and No. 41 (14 October 1988), p. 22.

^{5/} Ibid., No. 34 (26 August 1988).

^{6/} Ibid., No. 8 (26 February 1988).

^{7/} Ibid., pp. 14-19.

^{8/} Ibid., No. 10 (5-11 March 1988), p. 24.

The Syrian Arab Republic plans to construct an oil-fired 300 MW plant at Latakia, as well as a 120 MW petroleum coke-fired power station near Homs.^{1/} Plans to build substations near Damascus and Dumar are also under way.^{2/}

Power stations in the United Arab Emirates are generally owned by the individual emirates. They have a total installed capacity of 3,850 MW.^{3/} The federally owned capacity accounts for 513.9 MW, with plants being located in smaller cities. Work is currently being undertaken to expand existing facilities in Taweelah, Abu Dhabi and Jebal Ali, Dubai. The Taweelah project will be the largest power and water plant in the United Arab Emirates. Dubai also plans to build a 300 MW power and water desalination plant near the border at Sharjah.^{4/} The plant should be completed by 1991. Abu Dhabi is building substations in various parts of the country.

In addition to its rural power plans, Yemen also plans to link power stations and substations to form a national grid.^{5/} The system control centre will use computers to collate data, monitor substation operation and operate a load dispatch system. The total cost of the project will be \$US 14 million. Once initiated, it will take about 30 months to complete.

Countries of the ESCWA region have shown interest in the development of nuclear power to meet at least part of the region's electricity needs. Recent developments in the price of oil as well as the Chernobyl nuclear power accident, however, have reduced the incentive for the ESCWA countries to invest the large sums required for nuclear power plant development. However, on a regional level, the Regional Middle East Centre for Isotopes was reactivated in early 1988 after a 10 year hiatus.^{6/} Its thirtieth session was held in Cairo. It provides a forum for co-operation among Arab States and the opportunity to exchange expertise in the field of nuclear energy.

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- 1/ Middle East Economic Digest, vol. 32 (6-12 February 1988), p. 54.
 - 2/ Ibid., No. 19 (13 May 1988), p. 28.
 - 3/ Ibid., No.17 (29 April 1988), p. 30.
 - 4/ Ibid., No. 3 (16-22 January 1988), p. 37.
 - 5/ Ibid., No. 10 (5-11 March 1988), p. 72.
 - 6/ Al-Ahram, February 1989 (Arabic only).

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

The use of new and renewable sources of energy has been actively promoted by Governments and regional and international organizations in the ESCWA region. The private sector has also been involved in the production and development of new and renewable sources of energy in some countries of the region, including Jordan, Oman, Qatar and Saudi Arabia.

A. Developments in the use of new and renewable sources of energy (NRSE) during 1988

The relatively low price of conventional energy in recent years, including 1988, has, in all likelihood, had an adverse effect on private sector involvement in this field. Many ESCWA countries also subsidize energy products, which provides another impediment to private sector involvement in NRSE. Nevertheless, there was some activity on the part of the private sector in the region during 1988.

A joint venture was established in 1988 between BP and a Saudi Arabian firm, AH Algosaihi and Brothers, called BP Solar Arabia, with an authorized capital of \$US 2.3 million.^{1/} A factory will be established in Riyadh to produce 15,500 photovoltaic solar modules each year. Lighting systems, medical refrigerators and pumping systems, telecommunications and warning lights will be produced and marketed in Saudi Arabia and other GCC countries. Photovoltaics are currently used in Saudi Arabia to provide power to villages, and for remote telecommunications and tunnel and street lighting. Solar modules are also produced in Saudi Arabia by at least one other private company.

In 1988 a Jordanian firm, Arab Solar Industries Company, issued a licence to a firm in Gibraltar to produce solar heating equipment which will be offered for sale in Gibraltar, Spain and the United States. While this development does not imply an immediate increase in the utilization of solar energy within Jordan itself, it will help to establish the company's market world-wide and ensure its ability to provide products to the local market. In fact, the Arab Solar Industries Company exports about 40 per cent of the solar energy products it produces in Jordan.^{2/} Its annual total sales are approximately JD 4-5 million.^{3/} Solar water heaters are also used in Jordan. At the end of 1987, the number of units totalled 100,000.^{4/}

A number of wind energy generating projects began operating in Egypt in 1988, including a wind farm in Ras Ghareb with four units, each with a capacity of 100 kW. The farm generates power and is interconnected with the

1/ Middle East Economic Digest, vol. 32, No. 51 (23 December 1988), p. 42.

2/ Ibid., No. 19 (13 May 1988), p. 14.

3/ Ibid.

4/ Adnan I. O. Zaid, and others, "The potential and applications of renewable energy in Jordan", Proceedings of Energex 88, Tripoli, 25-30 November, 1988 (Tripoli, 1988), pp. XVIII-19 to XVIII-28. This figure represents 27 per cent of all households in Jordan.

local power grid. In addition, it has a one unit with a capacity of 55 kW which is used to make ice in Abu Ghosoun on the Red Sea. Another wind-powered unit with a capacity of 25 kW is operating in Mersa Matrouh to desalinate water using reverse osmosis. Another wind farm recently began operating in Sidi Barani. It has five units, each with a rated power generating capacity of 200 kW. Sadat City also has one wind-powered unit with a capacity of 10 kW to generate power and pump water. This unit was built under the auspices of the American University of Cairo. Another wind farm in East Oyannet was scheduled to begin operating in 1988. It consists of four units with a total power generating capacity of 260 kW.

A wind farm built in Jordan in the town of El-Ibrahimiya began operating in 1988. It has four units each with a capacity of 80 kW and produces electric power. Another project at Jarf El-Daraweesh is under way with two units each with a capacity of 20 kW and one unit with a capacity of 17.5 kW, which work together with solar photovoltaic panels of 50 kilowatt peak (kWp) for power generation.^{1/}

A proposed solar energy demonstration project to be implemented in the Syrian Arab Republic is currently under review. Saudi Arabia also encourages solar and wind energy use and currently has demonstration projects in various parts of the country. The King Abdul Aziz University, for example, has a solar energy project which supplies power to three villages.^{2/}

B. Activities in NRSE at the ESCWA secretariat during 1988

Activities undertaken to promote NRSE at the ESCWA secretariat include the implementation of a seminar and study tour on biogas technology for rural areas in selected arab countries.^{3/} In addition, biogas demonstration projects are being implemented in Democratic Yemen and are planned for Yemen and Jordan. This seminar provided a forum for more than 50 participants to discuss regional and international experience in the use of biogas technology. A manual for the design, construction, operation, repair and maintenance of family-sized biogas plants prepared by the ESCWA secretariat was adopted by the participants. A solar water pumping project in Tor El-Baha in Democratic Yemen was implemented by ESCWA in 1988 with the aid of financial support provided by the United Nations Development Fund for Women (UNIFEM). The water pump, powered by a solar photovoltaic panel of 900 watt peak, pumps water from a well 35 metres deep to a storage tank from which the villages draw their water. This has relieved part of the work-load of the women in the

^{1/} Adnan I. O. Zaid, and others, "The potential and applications of renewable energy in Jordan", Proceedings of Energex 88, Tripoli, 25-30 November, 1988 (Tripoli, 1988), pp. XVIII-19 to XVIII-28.

^{2/} Middle East Economic Digest, vol. 32, No. 51 (23 December 1988), p.42.

^{3/} Economic and Social Commission for Western Asia, Final Report of Seminar on Biogas Technology for Rural Areas in Selected Arab Countries Cairo, 26 November to 1 December 1988 (Baghdad, March 1989) (E/ESCWA/NR/88/WG.1/19).

village. The ESCWA secretariat also undertook a study on the prospects for biogas technology utilization in the Syrian Arab Republic, which was published in 1988.^{1/} This study examined the general characteristics of the country, its climatic conditions, demographic distribution, energy requirements, agricultural production and animal wealth. It was estimated that 158,000 digesters of different sizes could be built in rural areas of the the Syrian Arab Republic to help to satisfy local energy needs.

^{1/} Economic and Social Commission for Western Asia, Prospects for Biogas Technology Utilization in the Syrian Arab Republic (Baghdad, November 1988). (E/ESCWA/NR/88/WG.1/18) (Arabic only).

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